CHAPTER 34

NAVIGATION

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively.

Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary.

CH/SE/SU	C	PAGE	DATE
L.E.P.	R	A	Mar 28/02
L.E.P.	R	1	Mar 28/02
L.E.P.	R	2	Mar 28/02
L.E.P.	R	3	Mar 28/02
L.E.P.	R	4	Mar 28/02
L.E.P.	R	5	Mar 28/02
L.E.P.	R	6	Mar 28/02
L.E.P.	R	7	Mar 28/02
L.E.P.	R	8	Mar 28/02
L.E.P.	R	9	Mar 28/02
L.E.P.	R	10	Mar 28/02
L.E.P.	R	11	Mar 28/02
L.E.P.	R	12	Mar 28/02
L.E.P.	R	13	Mar 28/02
L.E.P.	R	14	Mar 28/02
L.E.P.	R	15	Mar 28/02
L.E.P.	R	16	Mar 28/02
L.E.P.	R	17	Mar 28/02
L.E.P.	R	18	Mar 28/02
L.E.P.	R	19	Mar 28/02
L.E.P.	R	20	Mar 28/02

CHAPTER 34

NAVIGATION

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively.

Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary.

CH/SE/SU	C		PAGE	DATE	CH/SE/SU	C	PAGE	DATE
S.B.LIST			1	Nov 30/81	34-00-00	02	8	Mar 31/95
S.B.LIST			2	Nov 30/81	34-00-00	02	9	Mar 31/95
S.B.LIST			3	Nov 30/81	34-00-00	02	10	Mar 31/95
S.B.LIST			4	Mar 31/95	34-00-00	02	11	Mar 31/95
S.B.LIST			5	Mar 29/96	34-00-00	02	12	Mar 31/95
					34-00-00	02	13	Mar 31/95
T. of C.			1	Mar 31/00	34-00-00	02	14	Mar 31/95
T. of C.			2	Mar 31/00	34-00-00	02	15	Mar 31/95
T. of C.			3	Mar 31/00	34-00-00	02	16	Mar 31/95
T. of C.			4	Mar 31/00	34-00-00	02	17	Mar 31/95
T. of C.			5	Mar 31/00	34-00-00	02	18	Mar 31/95
T. of C.			6	Mar 31/00	34-00-00	02	19	Mar 31/98
T. of C.			7	Mar 31/00	34-00-00	02	20	Mar 31/98
T. of C.			8	Mar 31/00	34-00-00	02	20A	Mar 31/98
T. of C.			9	Mar 31/00	34-00-00	02	20B	Mar 31/98
T. of C.			10	Mar 31/00	34-00-00	02	20C	Mar 31/98
T. of C.			11	Mar 31/00	34-00-00	02	20D	Mar 31/98
T. of C.			12	Mar 31/00	34-00-00	02	21	Mar 31/95
T. of C.			13	Mar 31/00	34-00-00	02	22	Nov 30/79
T. of C.			14	Mar 31/00	34-00-00	02	23	Nov 30/79
T. of C.		R	15	Mar 28/02	34-00-00	02	24	Feb 28/81
T. of C.		R	16	Mar 28/02	34-00-00	02	25	Feb 28/81
T. of C.			17	Mar 31/00	34-00-00	02	26	Feb 28/81
T. of C.			18	Mar 31/00	34-00-00	02	27	Feb 28/81
T. of C.			19	Mar 31/00	34-00-00	02	28	Feb 28/81
T. of C.			20	Mar 31/00	34-00-00	02	29	Feb 28/81
T. of C.			21	Mar 31/00	34-00-00	02	30	Feb 28/81
T. of C.			22	Mar 31/00	34-00-00	02	31	Feb 28/81
T. of C.			23	Mar 31/00	34-00-00	02	32	Feb 28/81
T. of C.			24	Mar 31/00	34-00-00	02	33	Mar 31/95
					34-00-00	02	34	Mar 31/95
34-00-00	02		1	Mar 31/95	34-00-00	02	35	Feb 28/81
34-00-00	02		2	Mar 31/95	34-00-00	02	36	Feb 28/81
34-00-00	02		3	Mar 31/95	34-00-00	02	36A	Mar 31/95
34-00-00	02		4	Mar 31/95	34-00-00	02	36B	Mar 31/95
34-00-00	02		5	Mar 31/95	34-00-00	02	37	Feb 28/81
34-00-00	02		6	Mar 31/95	34-00-00	02	38	Feb 28/81
34-00-00	02		7	Mar 31/95	34-00-00	02	39	Mar 31/95

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34-00-00		301	Mar 31/99	34-11-00		18	Aug 30/80
34-00-00		302	Mar 31/99	34-11-00		19	Mar 31/95
34-00-00		303	Mar 31/99	34-11-00		20	Dec 15/93
34-00-00		304	Mar 31/99	34-11-00		21	Nov 30/79
34-00-00		401	Nov 30/79	34-11-00		22	Nov 30/79
34-00-00		402	Nov 30/79	34-11-00		23	Dec 15/93
34-00-00		403	Mar 31/95	34-11-00		24	Aug 30/80
34-00-00		404	Jun 30/75	34-11-00		25	Aug 30/81
34-00-00		405	Nov 30/79	34-11-00		26	Aug 30/81
34-00-00		406	Nov 30/79	34-11-00		27	Aug 30/80
34-00-00		407	Nov 30/79	34-11-00		28	Aug 30/80
34-00-00		408	Mar 31/95	34-11-00		29	Aug 30/80
34-00-00		409	Nov 30/79	34-11-00		30	Aug 30/80
34-00-00		410	Mar 31/95	34-11-00		31	Aug 30/81
34-00-00		411	May 30/81	34-11-00		32	Aug 30/81
34-00-00		412	May 30/81	34-11-00		33	Aug 30/80
34-00-00		413	May 30/81	34-11-00		34	Aug 30/80
34-00-00		414	May 30/81	34-11-00		35	Aug 30/80
34-00-00		415	Aug 30/80	34-11-00		36	Aug 30/80
34-00-00		416	Aug 30/80	34-11-00		37	Aug 30/80
34-00-00		417	Aug 30/80	34-11-00		38	Aug 30/80
34-00-00		418	Mar 31/95	34-11-00		39	Aug 30/80
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34-10-00		1	Nov 30/79	34-11-00		41	Aug 30/81
34-10-00		2	Feb 28/79	34-11-00		42	Aug 30/81
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34-10-00		201	May 30/81	34-11-00		44	Aug 30/80
34-10-00		202	Aug 30/80	34-11-00		45	Aug 30/80
34-10-00		601	May 30/81	34-11-00		46	Aug 30/80
34-10-00		602	Jun 30/75	34-11-00		47	Aug 30/80
34-10-00		603	May 30/81	34-11-00		101	Nov 30/77
				34-11-00		102	Nov 30/77
34-11-00		1	Mar 31/95	34-11-00		103	May 30/78
34-11-00		2	May 30/77	34-11-00		104	May 30/78
34-11-00		3	May 30/77	34-11-00		105	May 30/78
34-11-00		4	May 30/77	34-11-00		106	May 30/78
34-11-00		5	Mar 31/95	34-11-00		107	May 30/78
34-11-00		6	Mar 31/95	34-11-00		108	May 30/78
34-11-00		7	Dec 15/93	34-11-00		109	May 30/78
34-11-00		8	Aug 30/80	34-11-00		110	May 30/78
34-11-00		9	Mar 31/95	34-11-00		111	May 30/78
34-11-00		10	Mar 31/95	34-11-00		112	May 30/78
34-11-00		11	Aug 30/80	34-11-00		113	May 30/78
34-11-00		12	Aug 30/80	34-11-00		114	May 30/78
34-11-00		13	Mar 31/95	34-11-00		115	May 30/78
34-11-00		14	Mar 31/95	34-11-00		116	May 30/78
34-11-00		15	Mar 31/95	34-11-00		117	May 30/78
34-11-00		16	Mar 31/95	34-11-00		118	May 30/78
34-11-00		17	Aug 30/80	34-11-00		119	May 30/78

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34-11-00		120	May 30/78	34-11-00		512	May 30/80
34-11-00		121	May 30/78	34-11-00		513	Aug 30/80
34-11-00		122	May 30/78	34-11-00		514	May 30/80
34-11-00		123	May 30/78	34-11-00		515	May 30/81
34-11-00		124	May 30/78	34-11-00		516	May 30/80
34-11-00		125	May 30/78	34-11-00		517	May 30/81
34-11-00		126	May 30/78	34-11-00		518	May 30/80
34-11-00		127	May 30/78	34-11-00		519	May 30/80
34-11-00		128	May 30/78	34-11-00		520	May 30/80
34-11-00		129	May 30/78	34-11-00		521	May 30/81
34-11-00		130	May 30/78	34-11-00		522	May 30/80
34-11-00		131	May 30/78	34-11-00		523	May 30/81
34-11-00		132	May 30/78	34-11-00		524	May 30/81
34-11-00		133	May 30/80	34-11-00		525	May 30/81
34-11-00		134	May 30/80	34-11-00		526	May 30/80
34-11-00		135	Aug 30/80	34-11-10		1	Mar 31/95
34-11-00		136	Aug 30/80	34-11-10		2	Feb 28/79
34-11-00		137	May 30/80	34-11-10		3	Feb 28/79
34-11-00		138	May 30/80	34-11-10		4	Nov 30/75
34-11-00		139	May 30/80	34-11-10		5	Feb 28/79
34-11-00		140	Aug 30/80	34-11-10		6	Feb 28/79
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34-11-00		143	May 30/80	34-11-10		9	Nov 30/75
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34-11-00		203	Nov 30/81	34-11-10		12	Nov 30/75
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34-11-00		205	Sep 30/92	34-11-10		14	Feb 28/79
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34-11-00		302	Aug 30/80	34-11-10		16	May 30/77
34-11-00		303	May 30/78	34-11-10		17	Nov 30/75
34-11-00		304	May 30/81	34-11-10		18	Nov 30/75
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34-11-00		309	Aug 30/80	34-11-10		23	Nov 30/75
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34-11-00		502	Aug 30/80	34-11-10		25	May 30/77
34-11-00		503	May 30/80	34-11-10		26	Nov 30/75
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34-11-00		505	May 30/80	34-11-10		28	Nov 30/79
34-11-00		506	May 30/81	34-11-10		29	May 30/77
34-11-00		507	May 30/81	34-11-10		30	Aug 30/76
34-11-00		508	May 30/80	34-11-10		31	May 30/77
34-11-00		509	May 30/80	34-11-10		32	May 30/77
34-11-00		510	May 30/80	34-11-10		33	May 30/77
34-11-00		511	May 30/80	34-11-10		34	Aug 30/76

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34-11-10		35	Aug 30/76	34-11-15		405	Aug 30/77
34-11-10		36	Aug 30/76	34-11-15		406	Aug 30/77
34-11-10		37	Aug 30/76	34-11-15		407	Aug 30/77
34-11-10		38	Aug 30/76	34-11-15		408	Aug 30/77
34-11-10		39	Aug 30/76	34-11-15		409	Aug 30/77
34-11-10		40	Aug 30/76	34-11-15		501	Aug 30/77
34-11-10		41	May 30/77	34-11-15		502	Aug 30/77
34-11-10		42	May 30/77	34-11-15		503	Feb 28/81
34-11-10		43	Feb 28/78	34-11-15		504	Feb 28/81
34-11-10		44	Feb 28/78	34-11-15		505	Aug 30/77
34-11-10		45	Feb 28/78	34-11-16		401	May 30/80
34-11-10		46	Feb 28/78	34-11-16		402	May 30/80
34-11-10		47	Mar 31/95	34-11-16		403	Feb 29/80
34-11-10		48	Dec 15/93	34-11-16		404	May 30/80
34-11-10		49	Mar 31/95	34-11-16		501	Aug 30/80
34-11-10		50	Dec 15/93	34-11-16		502	Aug 30/80
34-11-10		51	Mar 31/95	34-11-17		401	Nov 30/83
34-11-10		52	Mar 31/95	34-11-17		402	Nov 30/83
34-11-11		401	Mar 31/95	34-11-17		403	Nov 30/83
34-11-11		402	Mar 31/95	34-11-22		401	Aug 30/77
34-11-11		403	Mar 31/95	34-11-22		402	Aug 30/77
34-11-11		404	Mar 31/95	34-11-22		403	Aug 30/77
34-11-11		405	Mar 31/95	34-11-22		501	Aug 30/77
34-11-11		406	Mar 31/95	34-11-22		502	Aug 30/77
34-11-12		401	Aug 30/77	34-11-23		401	Aug 30/77
34-11-12		402	Aug 30/77	34-11-23		402	Aug 30/77
34-11-12		403	Aug 30/77	34-11-23		403	Aug 30/77
34-11-12		404	Aug 30/77	34-11-23		404	Aug 30/77
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34-11-12		406	Aug 30/77	34-11-23		502	Aug 30/77
34-11-13		201	Aug 30/80	34-11-23		503	Aug 30/77
34-11-13		401	Aug 30/80	34-11-24		401	Aug 30/77
34-11-13		402	Aug 30/77	34-11-24		402	Aug 30/77
34-11-13		403	Aug 30/77	34-11-24		403	Aug 30/77
34-11-13		404	Aug 30/77	34-11-24		404	Aug 30/77
34-11-13		405	Aug 30/77	34-11-24		501	Aug 30/77
34-11-13		406	Aug 30/77	34-11-24		502	Aug 30/77
34-11-13		407	Aug 30/80	34-11-24		503	Aug 30/77
34-11-13		408	Aug 30/80	34-11-27	01	1	Mar 27/97
34-11-14		401	Nov 30/76	34-11-27	01	2	Mar 27/97
34-11-14		402	Nov 30/76	34-11-27	01	3	Mar 27/97
34-11-14		403	Nov 30/76	34-11-27	01	4	Mar 27/97
34-11-14		404	Nov 30/76	34-11-27	01	5	Mar 27/97
34-11-14		405	Nov 30/76	34-11-27	02	1	Mar 27/97
34-11-15		201	Nov 30/81	34-11-27	02	2	Mar 27/97
34-11-15		401	May 30/78	34-11-27	02	3	Mar 27/97
34-11-15		402	Aug 30/77	34-11-27	02	4	Mar 27/97
34-11-15		403	Aug 30/77	34-11-27	02	5	Mar 27/97
34-11-15		404	Aug 30/77	34-11-27	01	101	Mar 27/97

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34-11-27	01	102	Mar 27/97	34-11-34		406	May 30/81
34-11-27	02	101	Mar 27/97	34-11-35		201	Aug 30/80
34-11-27	02	102	Mar 27/97	34-11-35		202	Aug 30/80
34-11-27	01	401	Mar 27/97	34-11-35		401	Mar 27/97
34-11-27	01	402	Mar 27/97	34-11-35		402	Aug 30/80
34-11-27	01	403	Mar 27/97	34-11-35		403	Aug 30/80
34-11-27	01	404	Mar 27/97	34-11-35		404	May 30/78
34-11-27	02	401	Mar 27/97	34-11-35		405	Aug 30/80
34-11-27	02	402	Mar 27/97	34-11-35		406	Aug 30/80
34-11-27	02	403	Mar 27/97	34-11-35		407	May 30/78
34-11-27	02	404	Mar 27/97	34-11-35		408	Aug 30/80
34-11-27	02	405	Mar 27/97	34-11-35		409	Aug 30/80
34-11-27	01	501	Mar 27/97	34-11-35		410	Aug 30/80
34-11-27	01	502	Mar 27/97	34-11-35		411	May 30/78
34-11-27	02	501	Mar 27/97	34-11-35		412	Aug 30/80
34-11-27	02	502	Mar 27/97	34-11-35		413	Aug 30/80
34-11-27	02	503	Mar 27/97	34-11-35		414	Aug 30/80
34-11-29		401	Sep 30/78	34-11-35		501	May 30/78
34-11-29		402	May 30/78	34-11-35		502	May 30/78
34-11-29		403	May 30/78	34-11-35		503	May 30/78
34-11-29		404	May 30/78	34-11-35		504	May 30/78
34-11-30		1	Aug 30/76	34-11-35		505	May 30/78
34-11-30		2	Aug 30/76	34-11-35		506	May 30/78
34-11-30		3	Nov 30/75	34-11-35		507	May 30/78
34-11-30		4	Nov 30/75	34-11-40		1	Nov 30/81
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34-11-30		6	Nov 30/75	34-11-40		3	Feb 28/77
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34-11-30		8	Aug 30/76	34-11-40		5	Nov 30/75
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34-11-30		201	Aug 30/80	34-11-40		7	Feb 28/77
34-11-30		202	Aug 30/80	34-11-40		8	Nov 30/75
34-11-30		203	Aug 30/80	34-11-40		9	Feb 28/77
34-11-31		401	Aug 30/80	34-11-40		10	Nov 30/75
34-11-31		402	Aug 30/80	34-11-40		11	Aug 30/76
34-11-31		403	Aug 30/80	34-11-40		12	Aug 30/76
34-11-31		404	Sep 30/92	34-11-40		13	Feb 28/77
34-11-31		405	Sep 30/92	34-11-40		14	Nov 30/75
34-11-31		406	Aug 30/80	34-11-40		15	Aug 30/76
34-11-31		601	Mar 27/97	34-11-40		16	Aug 30/76
34-11-32		401	Nov 30/75	34-11-40		17	Feb 28/77
34-11-32		402	Nov 30/79	34-11-40		18	Feb 28/77
34-11-32		403	Jun 30/75	34-11-40		19	Aug 30/77
34-11-32		404	Nov 30/79	34-11-40		20	Aug 30/77
34-11-34		401	Mar 31/00	34-11-40		21	Aug 30/77
34-11-34		402	Mar 31/00	34-11-40		22	Aug 30/77
34-11-34		403	May 30/80	34-11-40		23	Aug 30/76
34-11-34		404	Aug 30/80	34-11-40		24	Aug 30/77
34-11-34		405	Aug 30/80	34-11-40		25	Aug 30/77

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34-11-40		26	Aug 30/77	34-12-00		504	Aug 30/80
34-11-40		27	Feb 28/77	34-12-00		505	Nov 30/79
34-11-40		28	Aug 30/77	34-12-00		506	Nov 30/79
34-11-40		29	Aug 30/77	34-12-00		507	May 30/77
34-11-40		30	Aug 30/77	34-12-00		508	Nov 30/79
34-11-40		31	Aug 30/77	34-12-00		509	Nov 30/79
34-11-40		32	Aug 30/77	34-12-00		510	Nov 30/75
34-11-40		33	Feb 28/77	34-12-11		401	Aug 30/80
34-11-40		34	Aug 30/77	34-12-11		402	Aug 30/80
34-11-40		35	Aug 30/77	34-12-11		403	Aug 30/80
34-11-40		36	Aug 30/77	34-12-11		404	Sep 30/92
34-11-40		37	Aug 30/76	34-12-11		405	Sep 30/92
34-11-40		38	Aug 30/76	34-12-11		406	Aug 30/80
34-11-40		39	Aug 30/77	34-12-11		601	Mar 27/97
34-11-40		40	Aug 30/76	34-12-21		401	Nov 30/79
34-11-40		41	Aug 30/76	34-12-21		402	Nov 30/79
34-11-40		42	Aug 30/77	34-12-21		403	Nov 30/76
34-11-40		43	Aug 30/77	34-12-21		404	Nov 30/79
34-11-40		44	Aug 30/77	34-12-21		405	May 30/77
34-11-40		45	Aug 30/77				
34-11-40		201	Nov 30/80	34-13-00		1	Feb 28/81
34-11-41		401	Nov 30/78	34-13-00		2	Jun 30/75
34-11-41		402	Nov 30/78	34-13-00		3	Feb 28/81
34-11-41		403	Nov 30/78	34-13-00		4	Feb 28/81
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34-12-00		501	Aug 30/80	34-13-00		506	Feb 28/81
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34-12-00		503	Aug 30/80	34-13-22		401	May 30/78

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34-13-22		404	May 30/78	34-21-00		25	Nov 30/77
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34-13-24		401	Nov 30/78	34-21-00		30	Nov 30/77
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34-21-00		20	Jun 30/75	34-21-00	01	512	Aug 30/80
34-21-00		21	Jun 30/75	34-21-00	01	513	Aug 30/80
34-21-00		22	Jun 30/75	34-21-00	01	514	Aug 30/80

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34-21-00	02	507	Nov 30/79	34-22-00		4	Jun 30/75
34-21-00	02	508	Nov 30/79	34-22-00		5	Jun 30/75
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34-21-00	02	513	Nov 30/79	34-22-00		103	May 30/76
34-21-00	02	514	Nov 30/79	34-22-00		104	May 30/83
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34-21-35		401	Feb 28/79	34-23-00		23	May 30/78
34-21-35		402	Feb 28/79	34-23-00		24	Jun 30/75

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34-23-00		31	May 30/78	34-24-00		104	May 30/76
34-23-00		32	May 30/78	34-24-00		105	May 30/83
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34-23-00		103	Nov 30/76	34-24-16		405	May 30/77
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34-23-61		502	Nov 30/78	34-33-00		104	Aug 30/76
				34-33-00		105	Aug 30/76

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34-36-00		16	Nov 30/77	34-40-00		4	Mar 31/95

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34-41-00	R	4	Mar 28/02	34-41-00	N	102	Mar 28/02
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34-41-00	D	4B		34-41-00	N	104	Mar 28/02
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34-41-00	R	40	Mar 28/02	34-41-00	02 D	106	
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34-41-00	R	42	Mar 28/02	34-41-00	02 D	108	
34-41-00	R	43	Mar 28/02	34-41-00	02 D	109	
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34-41-00	R	45	Mar 28/02	34-41-00	02 D	111	

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34-41-00	02	D	120		34-41-18	D	409	
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34-41-00	02	D	122		34-41-21	R	402	Mar 28/02
34-41-00	02	D	123		34-41-21	R	403	Mar 28/02
34-41-00	02	D	124		34-41-21	R	404	Mar 28/02
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34-41-00	02	D	502		34-41-21	D	406	
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34-41-00	02	D	504		34-41-22	R	402	Mar 28/02
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34-41-00	02	D	517		34-41-60		401	May 30/78
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34-41-00	02	D	519		34-41-60		403	May 30/78
34-41-00	02	D	520		34-41-60		404	May 30/78
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34-45-13		402	Feb 28/79	34-46-00		112	Nov 30/81

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34-47-00		102	Aug 30/80	34-51-00		13	Nov 30/80
34-47-00		103	Aug 30/80	34-51-00		14	Nov 30/80
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SERVICE BULLETIN LIST

In the following service bulletin list, SB indicates an aircraft manufacturers bulletin, AEB indicates an airline engineering bulletin and OL indicates an engine manufacturers bulletin (complete identification OL.593-XX-XXX).

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
	SB 31-011		Nov 30/78	Embodied Instruments -Accessibility -To improve replacement times for various instruments, LH and RH pilot's panels
	SB 33-018		Aug 30/78	Embodied Lighting-Distance Measuring Equipment (DME) digital indication -To change supply of dimming circuit from 28VDC normal bus-bar to 28VDC emergency bus-bar, left hand side (LHS) only
R	SB 33-026		Nov 30/81	Embodied Lights. Filament Test - To clarify diagnosis of essential warning lights
	SB 34-001			No effect Navigation -Modification to the inertial signal comparator unit (ISCU) to preclude jerky movements of the handwheel and rudder pedals with the A.P. engaged.
	SB 34-001	01		No effect Navigation - Modification to the inertial signal comparator unit (ISCU) to preclude jerky movements of the handwheel and rudder pedals with the A.P engaged
	SB 34-002			No effect Navigation -To standardize A.D.F. wiring to Arinc Specification No.570
	SB 34-002	01		No effect Navigation - To standardize A.D.F. wiring to Aring specification No.570
	SB 34-003		Feb 28/77	Embodied Navigation -Improvement to "Crouzet" A.D.C.'s type 52
	SB 34-003	01		No effect Navigation -Improvement to "Crouzet" A.D.C.'s type 52
	SB 34-004			Embodied Navigation. Flight Environment Data -To add quick release connectors to manometric flexible hose installation forward of

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			instrument dash panel
SB 34-005		Feb 28/77	Embodied Navigation -VOR -To re-position the hybrid coupler.
SB 34-005	01	Feb 28/77	Embodied Navigation -VOR -To re-position the hybrid coupler.
SB 34-005	02	Feb 28/77	Embodied Navigation -VOR -To re-position the hybrid coupler.
SB 34-005	03	Feb 28/77	Embodied Navigation -VOR -To re-position the hybrid coupler.
SB 34-005	04		No effect Navigation -VOR -To re-position the hybrid coupler.
SB 34-006			No effect Navigation -Reduction of ADF compensation from 8a to 6a
SB 34-006	01		No effect Navigation -Reduction of ADF compensation from 8a to 6a
SB 34-007		May 30/77	Embodied Navigation -Addition of a diode in the machmeter at the input of the CG validity signal circuit
SB 34-007	01		No effect Navigation -Addition of a diode in the machmeter at the input of the CG validity signal circuit
SB 34-008			No effect Navigation -Radar -Improvement of line-arity in indicators
SB 34-008	01		No effect Navigation - Radar - Improvement of linea-rity in indicators
SB 34-008	02		No effect Navigation - Radar - Improvement of linea-rity in indicators
SB 34-009			No effect Navigation -Replacement of "Spectrol" potentiometers on angle-of-attack and side-slip sensors by "MCB" potentiometers
SB 34-009	01		No effect

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SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
SB 34-010			Navigation -Replacement of "Spectrol" potentiometers on angle-of-attack and side-slip sensors by "MCB" potentiometers Embodied
SB 34-010	01		Navigation. Angle of Attack and sideslip sensors. To differentiate between rigging alignment nuts and attachment bolts No effect
SB 34-011			Navigation. Angle of Attack and sideslip sensors. To differentiate between rigging alignment nuts and attachment bolts No effect
SB 34-012			Navigation. ADF1 and ADF2-To prevent cross-connection of loop and sensor aerial feeders at ADF1 and ADF2 receivers Not applicable
SB 34-012	01		Not applicable
SB 34-013			Not applicable
SB 34-014			No effect
SB 34-015			Revised VOR/LOC coupler inspection frequencies No effect
SB 34-016			Navigation, A.D.F. -To remove interference from Inertial Navigation system by re-locating earth points Embodied
SB 34-016	01	May 30/78	Navigation -Correction by the air data computers of static pressure differences between ADC 1 and ADC 2 systems Embodied
SB 34-016	02		Navigation -Correction by the air data computers of static pressure differences between ADC 1 and ADC 2 systems No effect
SB 34-017			Navigation. Correction by the Air Data Computers of static pressure differences between ADC 1 and ADC 2 systems No effect
SB 34-018			Navigation. Incidence and side-slip sensors-To introduce stainless steel bushes with integral rigging datum dowel holes in the sensor mountings. No effect
			Navigation -Radio altimeter -To prevent

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			ingression of moisture into the radio altimeter radio frequency (RF) aerial cable assemblies
SB 34-019			Not applicable
SB 34-020		Feb 28/78	Embodied Navigation. Weather radar-To change the type of nut on the scanner assembly
SB 34-021		May 30/78	Embodied Navigation - Re-route cable at flux valve 1F127 zone 231-1
SB 34-021	01		Embodied Navigation - Re-route cable at flux valve 1F127 zone 231-1
SB 34-022		Feb 28/79	Embodied Navigation. Altimeter - Install a pneumatic standby altimeter visible by both pilots
SB 34-022	01		Embodied Navigation. Altimeter - Install a pneumatic standby altimeter visble by both pilots
SB 34-022	02		No effect Navigation. Altimeter - Install a pneumatic standby altimeter visble by both pilots
SB 34-022	03		No effect Navigation. Altimeter - Install a pneumatic standby altimeter visble by both pilots
SB 34-023			No effect Navigation I.S.C.U. - Add undervoltage monitoring for 5v supply
SB 34-026			Embodied Navigation - TCAS and ATC mode S - wiring provisions
SB 34-026	01	Dec 15/93	Embodied Navigation - TCAS and ATC mode S - wiring provisions
SB 34-027			Embodied Navigation - TCAS II and ATC mode S - structure provisions for TCAS aerials and installation of coaxial cables

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	SB 34-027	01		Embodied Navigation - TCAS II and ATC mode S - structure provisions for TCAS aerials and installation of coaxial cables
	SB 34-027	02	Dec 15/93	Embodied Navigation - TCAS II and ATC mode S - structure provisions for TCAS aerials and installation of coaxial cables
	SB 34-028			Embodied Navigation - Installation and activation of ATC mode S system
	SB 34-028	01		Embodied Navigation - Installation and activation of ATC mode S system
	SB 34-028	02	Dec 15/93	Embodied Navigation - Installation and activation of ATC mode S system
	SB 34-029			Embodied Navigation - Installation of TCAS II system
	SB 34-029	01		Embodied Navigation - Installation of TCAS II system
R R R	SB 34-029	02		Embodied Navigation - Installation of TCAS II system
R R R	SB 34-029	03	Mar 29/96	Embodied Navigation - Installation of TCAS II system
	SB 34-030		Dec 15/93	Embodied Navigation - Relocation of coaxial relay on shelf 05-215 to improve access



MAINTENANCE MANUAL

CHAPTER 34

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General			1	ALL
Cabin Display Digital Converter			1	ALL
Dedicated Controller			2	ALL
Visual Display Unit (VDU) (4 off)			2	ALL
Operation			3	ALL
PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)	34-11-27	01		
Trouble Shooting			101	ALL
General Fault Finding			101	ALL
Fault Finding			101	ALL
PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)	34-11-27	02		
Trouble Shooting			101	ALL
General Fault Finding			101	ALL
Fault Finding			101	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)	34-11-27	01		
Removal/Installation			401	ALL
Display Unit - Removal/Installation			401	ALL
Converter Box - Removal/Installation			401	ALL
Dedicated Controller - Removal/Installation			402	ALL
PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)	34-11-27	02		
Removal/Installation			401	ALL
Visual Display Unit, Part No. 999-44115-201 Removal/Installation			401	ALL
Digital Converter Box - Removal/Installation			401	ALL
Controller - Removal/Installation			402	ALL
PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)	34-11-27	01		
Adjustment/Test			501	ALL
System Functional Check			501	ALL
PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)	34-11-27	02		
Adjustment/Test			501	ALL
Operational Test			501	ALL
System Functional Check			501	ALL
ADC CONTROL PANEL	34-11-29			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
SENSING	34-11-30			
Description and Operation			1	ALL
General			1	ALL
Description of Sensors			1	ALL
Sensor - Angle of Attack			2	ALL
Probe - Heated Total Temperature			3	ALL
Pitot Head - Fuselage Mounted			5	ALL
Static Ports - ADS Heated			7	ALL
Maintenance Practices			201	ALL
General			201	ALL
Pitot Heads - Area Damage Limitations			201	ALL
Sensors - Area Damage Limitations			203	ALL
ANGLE OF ATTACK SENSOR	34-11-31			
Removal/Installation			401	ALL
General			401	ALL
Angle of Attack Sensors			401	ALL
Inspection/Check			601	001-006,
General			601	001-006,

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
TOTAL TEMPERATURE SENSOR	34-11-32			
Removal/Installation			401	ALL
General			401	ALL
Total Temperature Sensor			401	ALL
FUSELAGE MOUNTED PITOT HEAD	34-11-34			
Removal/Installation			401	ALL
General			401	ALL
Fuselage Mounted Pitot Heads			401	ALL
Insulation and Resistance Check of Fuselage Mounted Pitot Heads			405	ALL
STATIC PORTS	34-11-35			
Maintenance Practices			201	ALL
General			201	ALL
Static Plate Damage Limitations			201	ALL
Removal/Installation			401	ALL
General			401	ALL
Static Ports			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Test			501	ALL
AIR DATA COMPUTER	34-11-40			
Description and Operation			1	ALL
General			1	ALL
Description			1	ALL
Operation			3	ALL
Maintenance Practices			201	ALL
Leak Checks			201	ALL
AIR DATA COMPUTER	34-11-41			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL
SIDESLIP	34-12-00			
Description and Operation			1	ALL
General			1	ALL
System Components			1	ALL
Angle of Sideslip Sensor			1	ALL
Sideslip Indicator			2	ALL
General Operation			3	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			103	ALL
Maintenance Practices			201	ALL
General			201	ALL
Sensors - Area Damage Limitations			201	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			505	ALL
System Test			510	ALL
ANGLE OF SIDESLIP SENSOR	34-12-11			
Removal/Installation			401	ALL
General			401	ALL
Sideslip Sensor			401	ALL
Inspection/Check			601	001-006,
General			601	001-006,
SIDESLIP INDICATOR	34-12-21			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
STANDBY AIR DATA INSTRUMENTATION	34-13-00			
Description and Operation			1	ALL
General			1	ALL
Description			1	ALL
Indicator - Airspeed/Mach			1	ALL
Indicator - Airspeed			7	ALL
Altimeter			10	ALL
Altimeter Standby			13	ALL
System Operation			13	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			104	ALL
Maintenance Practices			201	ALL
Leak Checks			201	ALL
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			504	ALL
System Test			506	ALL
AIRSPEED/MACH INDICATOR	34-13-22			
Maintenance Practices			201	ALL
Leak Checks			201	ALL
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
AIRSPEED INDICATOR	34-13-23			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
ALTIMETER	34-13-24			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
NOSE PROBE	34-13-33			
Description and Operation			1	ALL
General			1	ALL
Description - Operation			1	ALL
Maintenance Practices			201	ALL
Leak Checks			201	ALL
Removal/Installation			401	ALL
General			401	ALL
Nose Probe			401	ALL
Inspection/Check			601	ALL
General			601	ALL
Nose Probe			601	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
ATTITUDE AND DIRECTION	34-20-00			
Description and Operation			1	ALL
General			1	ALL
Heading Information			1	ALL
Attitude Information			1	ALL
Acceleration Information			4	ALL
Flight Director Instruments			4	ALL
COMPASS COUPLER	34-21-00			
Description and Operation			1	ALL
General			1	ALL
System Components			1	ALL
Flux-Valve - SPERRY 4002342			2	ALL
Compensator - Electronic, Remote, SPERRY 2575513			4	ALL
Controller - Dual, MHRS, SPERRY 2592801-902			5	ALL
Compass Coupler - SPERRY 2592799-902			7	ALL
Operation			19	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			102	ALL
COMPASS COUPLER	34-21-00	01		
Adjustment/Test			501	006-007,
Operational Test			501	006-007,
Functional Test			507	006-007,
System Test			515	006-007,
COMPASS COUPLER	34-21-00	02		
Adjustment/Test			501	001-005,
Operational Test			501	001-005,
Functional Test			507	001-005,
System Test			514	001-005,
MHRS CONTROLLER	34-21-12			
Removal/Installation			401	ALL
General			401	ALL
MHRS Controller			401	ALL
FLUX VALVE	34-21-17			
Removal/Installation			401	ALL
General			401	ALL
Flux Valve			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Flux Valve Compensation			502	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
FLUX VALVE COMPENSATOR	34-21-18			
Removal/Installation			401	ALL
General			401	ALL
Compensator - Flux Valve			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Compensator - Flux Valve			501	ALL
COMPASS COUPLER SWITCHING UNIT	34-21-31			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
COMPASS COUPLERS 1F126 & 2F126	34-21-35			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
COMP1 - COMP2 SWITCH	34-21-41			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
STANDBY HORIZON	34-22-00			
Description and Operation			1	ALL
General			1	ALL
Systems Components			1	ALL
Description			1	ALL
Operation			3	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			102	ALL
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			502	ALL
System Test			502	ALL
STANDBY HORIZON	34-22-11			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL
STATIC INVERTER	34-22-12			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
FLIGHT DIRECTOR INSTRUMENTS	34-23-00			
Description and Operation			1	ALL
General			1	ALL
Horizontal Situation Indicator (HSI)			1	ALL
Attitude Director Indicator (ADI)			14	ALL
Track Heading Unit			32	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			102	ALL
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			505	ALL
System Test			507	ALL
HORIZONTAL SITUATION INDICATOR (HSI)	34-23-11			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
ATTITUDE DIRECTOR INDICATOR (ADI)	34-23-12			
Trouble Shooting			101	ALL
Inertial Comparator Tilting of ADI Spheres			101	ALL
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
VOR-ILS & RAD-INS SWITCHING UNITS 1F24 & 2F24	34-23-13			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
PITCH ATTITUDE PRESETTING POTENTIOMETER	34-23-15			
Removal/Installation			401	ALL
General			401	ALL
Pitch Attitude Presetting Potentiometer			401	ALL
RAD-INS SWITCH	24-23-17			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
TRACK HEADING UNIT	34-23-61			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
ACCELERATION INDICATION	34-24-00			
Description and Operation			1	ALL
General			1	ALL
System Components			1	ALL
Description			1	ALL
Operation			2	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			103	ALL
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			502	ALL
System Test			502	ALL
ACCELEROMETER F38 AND F39	34-24-16			
Removal/Installation			401	ALL
General			401	ALL
Accelerometers F38 and F39			401	ALL
STANDBY COMPASS	34-25-00			
Description and Operation			1	ALL
General			1	ALL
Standby Compass SMITHS KCA 0105W			1	ALL
Adjustment/Test			501	ALL
General			501	ALL
Standby Compass Check and Compensation			501	ALL
Standby Compass Check Swing			506	ALL
B DEMAGNETIZATION OF AIRCRAFT STRUCTURE	34-25-21			
B Maintenance Practices			201	ALL
B General			201	ALL
B Demagnetization Procedure			201	ALL
B STANDBY COMPASS	34-25-21			
Removal/Installation			401	ALL
General			401	ALL
Standby Compass			401	ALL
Compass Deviation Card			404	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
LANDING AND TAXIING AIDS	34-30-00			
Description and Operation			1	ALL
General			1	ALL
I.L.S. System			1	ALL
MARKER BEACON System			1	ALL
MARKER BEACON SYSTEM	34-33-00			
Description and Operation			1	ALL
General			1	ALL
System Components			1	ALL
Receiver-Marker Beacon, COLLINS 51Z4			2	ALL
Antenna-Built-in, STAREC Type 1202			4	ALL
System Operation			4	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			102	ALL
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			504	ALL
System Test			507	ALL
ANTENNA	34-33-11			
Removal/Installation			401	ALL
General			401	ALL
Antenna			401	ALL
MARKER BEACON RECEIVER	34-33-12			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL
INDICATOR LIGHT ASSEMBLY	34-33-21			
Removal/Installation			401	ALL
General			401	ALL
Relamping			401	ALL
Removal/Installation of Indicator Light Assembly			402	ALL
Replacement of TEST Push-Button			407	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
INSTRUMENT LANDING SYSTEM (I.L.S.)	34-36-00			
Description and Operation			1	ALL
General			1	ALL
System Components			1	ALL
Receiver-ILS - BENDIX RIA, 32A			1	ALL
Antenna-VOR Type ACV0 102 or CHELTON 19-182			14	ALL
Antenna-VHF - GLIDE type ACGL 102 or CHELTON 19-180			14	ALL
Control Box - VOR/ILS/DME EAS BN 1671D (PN5002100006)			18	ALL
ILS System Operation			19	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			102	ALL
Maintenance Practices			201	ALL
Cat 3 Autoland			201	ALL
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			505	ALL
System Test			510	ALL
ILS RECEIVERS 1R37 & 2R37	34-36-31			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
VHF2/GLIDE/ANTENNA	34-36-32			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL

	SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
	INDEPENDENT POSITION DETERMINING	34-40-00			
	Description and Operation			1	ALL
	General			1	ALL
	Weather Radar Systems			1	ALL
	Radio Altimeter Systems			1	ALL
	Inertial Navigation Systems			2	ALL
	Inertial Signals Comparator Unit (ISCU)			5	ALL
	Ground Proximity Warning System (GPWS)			5	ALL
	TCAS System			5	ALL
RB	WEATHER RADAR RDR-4B	34-41-00			
RB	Description and Operation			1	ALL
RB	General			1	ALL
RB	System Breakdown			8	ALL
RB	System Description			39	ALL
RB					
RB	Trouble Shooting			101	ALL
RB	General			101	ALL
RB	Prepare for Trouble Shooting			103	ALL
RB	Fault Finding Tests			105	ALL
RB	System Shutdown Procedure			113	ALL
RB	Adjustment/Test			501	ALL
RB	General			501	ALL
RB	Operational Test			503	ALL
RB					
RB	System Test			506	ALL
RB					
RB	Cleaning/Painting			701	ALL
RB	General			701	ALL
RB	Filter Cleaning			701	ALL
	WEATHER RADAR ANTENNA	34-41-11			
	Removal/Installation			401	ALL
	General			401	ALL
	Weather Radar Antenna			401	ALL
	Adjustment/Test			501	ALL
	Tests			501	ALL
	WEATHER RADAR CONTROL PANEL	34-41-12			
	Removal/Installation			401	ALL
	General			401	ALL
	Weather Radar Control Panel			401	ALL
	WAVE GUIDE SWITCH S29	34-41-18			
	Removal/Installation			401	ALL
	General			401	ALL
	Wave Guide Switch S29			401	ALL

	SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
	WEATHER RADAR INDICATOR	34-41-21			
	Removal/Installation			401	ALL
	General			401	ALL
	Removal/Installation			401	ALL
RB	INDICATOR UNIT/RADAR ALERT	34-41-22			
RB	Removal/Installation			401	ALL
RB	General			401	ALL
RB	Indicator Unit			401	ALL
RB	Indicator Unit Relamping			405	ALL
RB					
RB	Adjustment/Test			501	ALL
RB	General			501	ALL
RB					
	WEATHER RADAR TRANSCEIVER	34-41-33			
	Removal/Installation			401	ALL
	General			401	ALL
	Weather Radar Transceiver			401	ALL
	DESSICATOR ASSEMBLY	34-41-60			
	Servicing			301	ALL
	General			301	ALL
	Replacement of Silicagel in Dessicator Assembly			301	ALL
	Removal/Installation			401	ALL
	General			401	ALL
	Dessicator Cartridge			401	ALL
	Seat			403	ALL
	Inspection/Check			601	ALL
	General			601	ALL
	Inspection/Check			601	ALL
	RADIO ALTIMETER	34-42-00			
	Description and Operation			1	ALL
	General			1	ALL
	System Components			1	ALL
	Transceiver - TRT AHV5			1	ALL
	Altitude Indicator TRT - IND-521			8	ALL
	TRT-AHV5-401 Antenna			12	ALL
	Operation			12	ALL
	Trouble Shooting			101	ALL
	General			101	ALL
	Prepare			101	ALL
	Trouble Shooting			103	ALL
	Maintenance Practices			201	ALL
	Cat 3 Autoland			201	ALL
	Adjustment/Test			501	ALL
	Operational Test			501	ALL
	Functional Test			509	ALL
	No.1 and No.2 Radio Altimeter Transit Check			514	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
RADIO ALTIMETER INDICATOR	34-42-21			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL
RADIO ALTIMETER ANTENNA	32-42-31			
Removal/Installation			401	ALL
General			401	ALL
Radio-Altimeter Antenna			401	ALL
RADIO ALTIMETER TRANSCEIVERS	34-42-41			
Removal/Installation			401	ALL
General			401	ALL
Radio Altimeter Transceivers			401	ALL
TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)	34-43-00			
Description and Operation			1	ALL
TCAS System Description			1	ALL
System Components			7	ALL
TCAS Computer			12	ALL
ATC/TCAS Control Panel (S11)			27	ALL
VSI/TCAS Indicator S87, S88			28	ALL
TCAS Antennae			39	ALL
VSI/TCAS ADC Amplifier (S94)			41	ALL
Audio Mixing Box (S89)			46	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			104	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
System test			510	ALL
TCAS ANTENNA	34-43-11			
Removal/Installation			401	ALL
General			401	ALL
TCAS Antenna			401	ALL
TCAS/ATC MODE S CONTROL UNIT	34-43-13			
Removal/Installation			401	ALL
General			401	ALL
VSI/TCAS INDICATOR-S88	34-43-23			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
TCAS COMPUTER	34-43-33			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
TCAS AUDIO MIXING BOX	34-43-43			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
VSI/TCAS ADC AMPLIFIER	34-43-53			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
INERTIAL NAVIGATION SYSTEM	34-45-00	02		
Description and Operation			1	ALL
General			1	ALL
Inertial Navigation System			14	ALL
INS Interconnections			24	ALL
Mode Selector Unit (MSU)			28	ALL
Control/Display Unit (CDU)			31	ALL
Battery Unit (BU)			41	ALL
Navigation Unit (NU)			43	ALL
R/Nav Annunciators			55	ALL
Automatic Data Entry Unit			55	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			104	ALL
Trouble Shooting			105	ALL
INERTIAL NAVIGATION SYSTEM	34-45-00			
Maintenance Practices			201	ALL
General			201	ALL
Programme Changes			201	ALL
INS Card Readers (ADEU)			203	ALL
INERTIAL NAVIGATION SYSTEM	34-45-00	02		
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			510	ALL
System Test			522	ALL
MODE SELECTOR UNITS	34-45-12			
Servicing			301	ALL
General			301	ALL
Relamp MSU Annunciators			301	ALL
Test MSU Lamps			301	ALL
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
CONTROL DISPLAY UNITS	34-45-13			
Servicing			301	ALL
General			301	ALL
Relamp CDU Keys and Annunciators			301	ALL
Test CDU Lamps			302	ALL
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
ATT - INS SWITCH	34-45-14			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
WARNING INDICATOR	34-45-15			
Removal/Installation			401	ALL
General			401	ALL
Warning Indicator Removal/ Installation			401	ALL
Replacement of Warning Indicator Lamp			403	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL
AUTOMATIC DATA ENTRY UNIT (ADEU)	34-45-16			
Removal/Installation			401	ALL
General			401	ALL
NAV - INS SWITCH	34-45-17			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
R/NAV ANNUNCIATORS	34-45-18			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
INERTIAL NAVIGATION UNITS, 1F8, 2F8 AND 3F8	34-45-34			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
ATT INS & NAV SWITCHING UNITS 1F9 & 2F9	34-45-35			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL
BATTERY UNITS 1F10, 2F10 AND 3F10	34-45-38			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
INERTIAL SIGNALS COMPARATOR UNIT (ISCU)	34-46-00			
Description and Operation			1	ALL
General			1	ALL
Inertial Signals Comparator Unit			1	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			103	ALL
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			505	ALL
INERTIAL SIGNAL COMPARATOR UNIT (ISCU)	34-46-11			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
GROUND PROXIMITY WARNING SYSTEM	34-47-00			
Description and Operation			1	ALL
General			1	ALL
Computer			1	ALL
Warning Indicator Lights			1	ALL
Aural Warning			2	ALL
Operation			2	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			103	ALL
B				
B				
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			505	ALL
System Test			514	ALL
FLASHER UNIT	34-47-11			
Removal/Installation			401	ALL
General			401	ALL
Flasher Unit			401	ALL
GROUND PROXIMITY WARNING COMPUTER	34-47-12			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
DEPENDENT POSITION DETERMINING	34-50-00			
Description and Operation			1	ALL
General			1	ALL
VOR System			1	ALL
ADF System			1	ALL
ATC System			1	ALL
DME System			2	ALL
TCAS System			2	ALL
DISTANCE MEASURING EQUIPMENT (DME)	34-51-00			
Description and Operation			1	ALL
General			1	ALL
System Components			1	ALL
Interrogator - DME, Collins 860E-3			1	001-005,
Interrogator - DME, Collins 860E-5			13	006-007,
Control Unit - VOR/ILS/DME, EAS-BN1-671D			22	ALL
Indicator - Dual DME, Clifton			23	ALL
Antenna - Embedded, Starec Type 292			25	ALL
Operation of System			25	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			103	ALL
DISTANCE MEASURING EQUIPMENT (DME)	34-51-00	02		
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			506	ALL
System Test			511	ALL
DISTANCE MEASURING EQUIPMENT (DME) ANTENNA	34-51-11			
Removal/Installation			401	ALL
General			401	ALL
DME Antenna			401	ALL
DUAL DME INDICATOR	34-51-23			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
DME INTERROGATORS 1S1 & 2S1	34-51-33			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
AIR TRAFFIC CONTROL (ATC) - MODE S	34-52-00	02		
Description and Operation			1	ALL
General			1	ALL
System Components and location			1	ALL
Collins TPR-720 ATC/Mode S Transponder			9	ALL
ATC Mode S Antenna			25	ALL
Antenna Switching Relay S21			27	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
AIR TRAFFIC CONTROL MODE S (ATC)	34-52-00	03		
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			104	ALL
AIR TRAFFIC CONTROL MODE S (ATC)	34-52-00			
Adjustment Test			501	ALL
Operational Test			501	ALL
Functional Test			503	ALL
AIR TRAFFIC CONTROL (ATC) MODE S ANTENNA	34-52-11			
Removal/Installation			401	ALL
General			401	ALL
ATC Mode S Antenna			401	ALL
ATC MODE S CONTROL UNIT S11	34-52-13			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
ATC MODE S TRANSPONDERS 1S10 & 2S10	34-52-33			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
AUTOMATIC DIRECTION FINDING (ADF)	34-53-00			
Description and Operation			1	ALL
General			1	ALL
System Components			1	ALL
Receiver ADF Marconi-Elliott AD380			1	ALL
Controller ADF GABLES G3749			14	ALL
Bearing Indicator RMI/ADF E.A.S. 1VA 551D			15	ALL
System Operation			19	ALL
AUTOMATIC DIRECTION FINDING (ADF)	34-53-00	02		
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			102	ALL
Adjustment/Test			501	ALL
Operational Test			501	ALL
Functional Test			505	ALL
System Test			507	ALL
AUTOMATIC DIRECTION FINDING (ADF) LOOP ANTENNA	34-53-11			
Removal/Installation			401	ALL
General			401	ALL
ADF Loop Antenna			401	ALL
ADF RECEIVER	34-53-12			
Removal/Installation			401	ALL
General			401	ALL
ADF Receiver			401	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
Adjustment/Test			501	ALL
General			501	ALL
ADF Receiver			501	ALL
SENSE ANTENNA	34-53-14			
Removal/Installation			401	ALL
General			401	ALL
Sense Antenna			401	ALL
"Susceptiformer" Coupler			404	ALL
RMI/ADF INDICATOR	34-53-21			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
ADF CONTROLLER	34-53-32			
Removal/Installation			401	ALL
General			401	ALL
ADF Controller			401	ALL
VHF/OMNIRANGE	34-55-00			
Description and Operation			1	ALL
General			1	ALL
System Components			3	ALL
Receiver - VOR RVA 33A, PN 2070.750.3305, BENDIX			3	ALL
Control Unit BN 671D PN50021.00.006			14	ALL
Indicator - Radio Magnetic RMI/VOR - EAS Type IVA552			15	ALL
Antenna - VOR/LOC ACV0102			20	ALL
System Operation			23	ALL
Switching of VOR Information to the Indicators			27	ALL
Trouble Shooting			101	ALL
General			101	ALL
Prepare			101	ALL
Trouble Shooting			102	ALL
VHF OMNIRANGE	34-55-00	01		
Adjustment/Test			501	006-007,
Operational Test			501	006-007,
Functional Test			505	006-007,
System Test			511	006-007,
VHF OMNIRANGE	34-55-00	02		
Adjustment/Test			501	001-005,
Operational Test			501	001-005,
Functional Test			506	001-005,
System Test			511	001-005,
VOR/LOC ANTENNA COUPLER	34-55-00			
Inspection/Check			601	ALL
General			601	ALL
Inspection/Check of VOR/LOC Antenna Couplers			601	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
VOR/LOC ANTENNA	34-55-11			
Removal/Installation			401	ALL
General			401	ALL
VOR/LOC Antenna			401	ALL
Test			402	ALL
Close-Up			402	ALL
VOR/ILS/DME CONTROL UNITS 1R28 & 2R28	34-55-13			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
DEV1 - DEV2 SWITCH	34-55-14			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Adjustment/Test			501	ALL
RMI/VOR INDICATOR	34-55-22			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
VOR RECEIVERS 1R24 & 2R24	34-55-31			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
RF SWITCH	34-55-32			
Removal/Installation			401	ALL
General			401	ALL
Removal/Installation			401	ALL
Tests			405	ALL
Close-Up			405	ALL

GENERAL - DESCRIPTION AND OPERATION

1. General

In order to continuously determine its position along its track, the aircraft is equipped with flight environment navigation systems.
The purpose of the navigation system is to determine position, to supply guidance signals and to indicate parameters. The system is divided into independent and dependent position determining systems.
Sensing of environmental parameters enables measurement and indication of temperature, airspeed, altitude and acceleration.
In addition to the dual main systems, the aircraft is equipped with independent standby systems, standby horizon and standby compass.

2. System Components

A. Flight Environment Data (Ref. Fig. 001)

(1) Normal air data system

The normal air data system measures external parameters by means of pitot probes and static ports. The system also uses, for electrical compensation, centre of gravity and aircraft droop nose position information. The Air Data Computers (ADC), supply to the peripherals and instruments concerned the processed parameters, Mach No. M, airspeed VC, altitude HP and vertical speed Vz.

(2) Sideslip

In flight, the angle of airflow with reference to aircraft centre line is measured by means of angle of sideslip sensors. The angle in degrees is indicated on the Captain and First Officer instrument panels by two sideslip indicators.

(3) Standby air data system

The standby air data system measures external parameters by means of the nose probe. Mach No., Vmo and altitude are indicated on the airspeed/mach indicator and on the altimeters and airspeed indicators of the normal air data system when they are switched to STBY position.

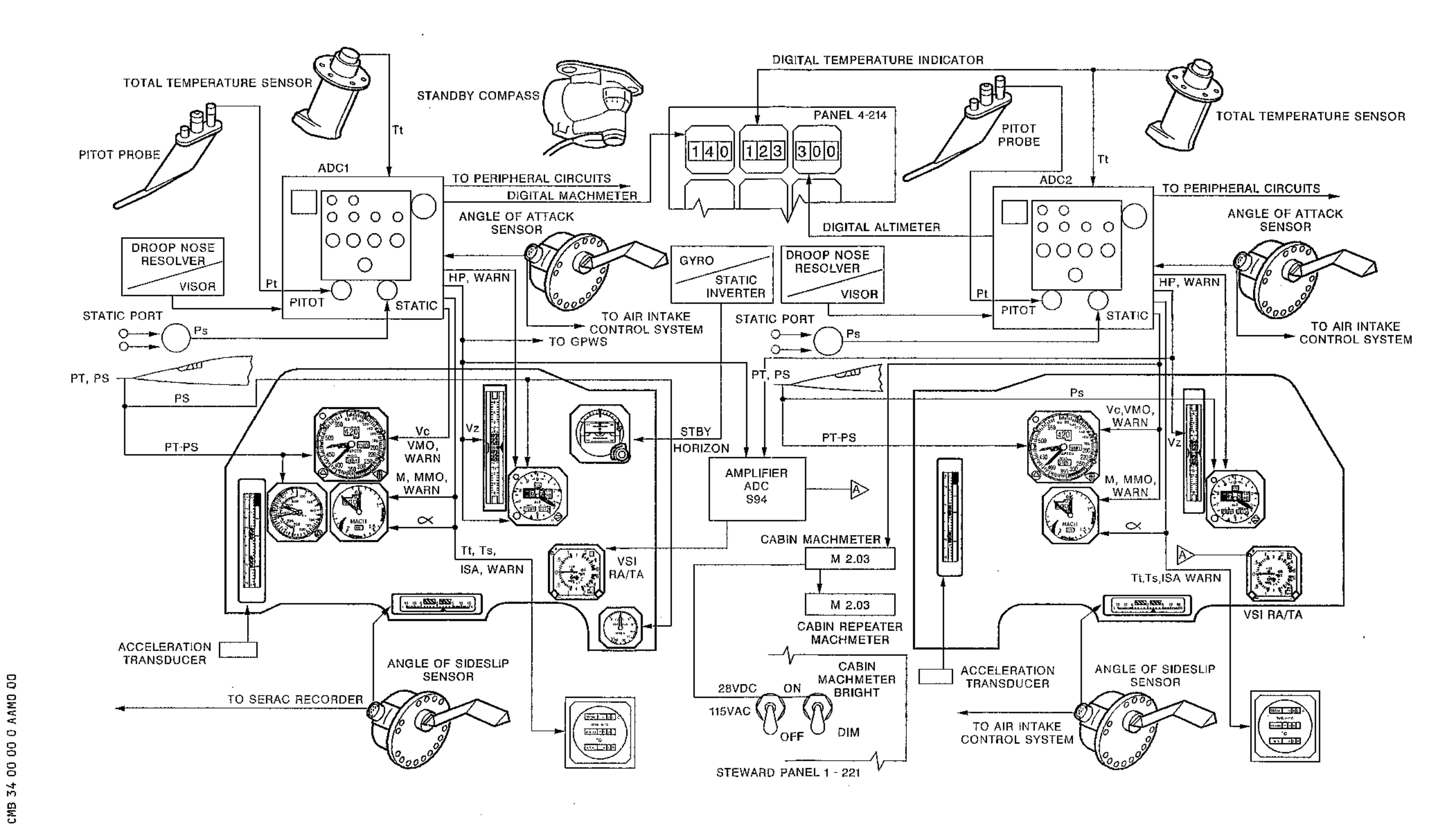
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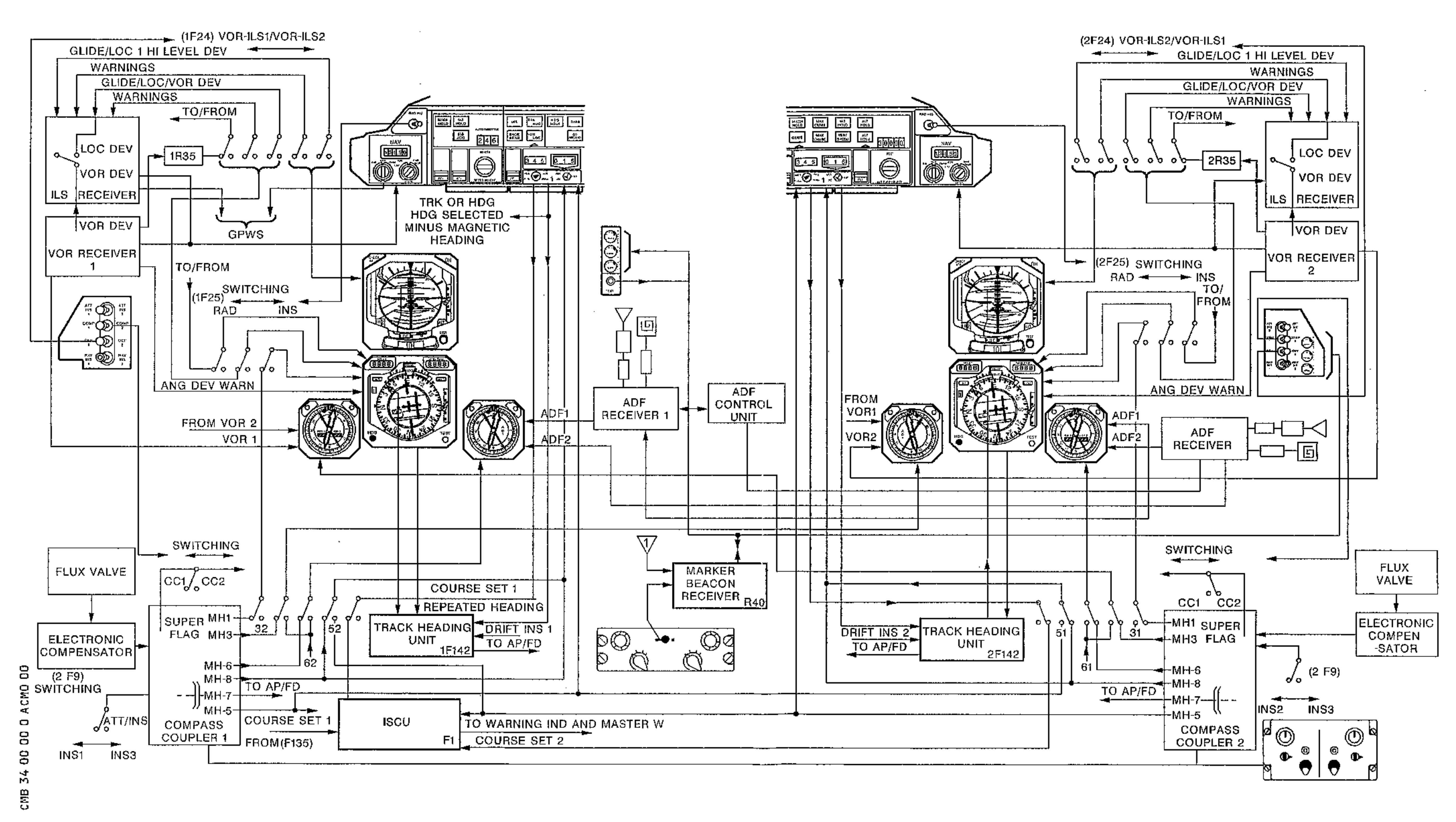
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R
R

Flight Environment Data
Figure 001



R

Attitude and Direction
Figure 002

B. Attitude and Direction (Ref. Fig. 002)

(1) Compass coupler

The compass coupler systems supply aircraft magnetic heading. They operate in two modes:
MAG: Inertial Navigation System (INS) platform heading stabilises the flux valve magnetic heading, compensator for accelerations.
DG: the system repeats INS platform heading compensated for earth rate rotation.

(2) Flight director instruments
(Ref. Fig. 002 and 003)

R

For indication of certain flight parameters required to maintain the aircraft on the selected track the Captain and First Officer have available two indicators, a track heading unit and an acceleration indicator.

(a) Horizontal Situation Indication (HSI)

These two indicators are used essentially for navigation. Depending on the switch positions they provide indication of information from the various aircraft navigation systems. The type and origin of the information in either RADIO or INS mode are as follows:

- Aircraft heading (True or Magnetic)
- INS track or selected heading
- Drift (INS)
- Desired track (INS or Magnetic)
- Aircraft position with respect to a beam (VOR-ILS)
- TO/FROM direction indication (INS or VOR)
- Distance TO GO indication (INS)
- Groundspeed indication (INS)
- Aircraft position with respect to a beam (ILS)
- Heading comparison warning (instrument or approach monitoring)
- Warning: Internal Monitoring - Information Monitoring.

(b) Attitude Director Indicator (ADI)

These two indicators are used essentially in flight control. Depending on the switch positions they provide indication of information from the relevant aircraft systems.

These are:

- Attitude indication (INS)
- FD bars controlled by the AP/FD computers
- Runway Guidance Information (AP/FD computer)
- Attitude from 240 ft to the ground (radio altimeter)
- Aircraft position with reference to a beam (ILS)
- An indicator light illuminates when decision height selected on the radio altimeter is reached
- A second indicator light indicates an altitude deviation greater than a preset threshold between the two indicators
- Warnings: Internal Monitoring - Information Monitoring.

(c) Track Heading Unit

Each unit processes error signals by means of electromechanical devices, the signals are sent to the AP computers and associated HSI indicators. (Selected heading minus magnetic heading or true heading). From this information desired track is calculated and displayed on the HSI.

(3) Acceleration Indicators (Ref. Fig. 001)

The acceleration transducers measure vertical acceleration which is indicated on two angle of attack and acceleration indicators on the Captain and First Officer instrument panels respectively.

C. Independent Standby Systems (Ref. Fig. 001)

(1) Standby Horizon

The independent standby horizon continuously displays aircraft roll-pitch attitude.

(2) Standby Compass

The independent standby compass continuously indicates on a compass card aircraft heading with reference to magnetic north.

D. Landing and Taxiing Aids (Ref. Fig. 002)

(1) Marker Beacon Receiver

The marker beacon receiver indicates flight over beacons by means of illumination of beacon identification indicator lights on the Captain and First Officer instrument panels, accompanied by audio tones.

(2) ILS Receiver

Aircraft position in a GLIDE PATH/LOCALIZER beam is detected by the aircraft receivers and displayed on the HSI and ADI indicators. The ILS frequencies are selected on the VOR/ILS/DME control unit.

E. Independent Position Determining (Ref. Fig. 003)

(1) Weather Radar

Operating in the X band, the weather radar consists of two independent systems using a common antenna. In addition to its meteorological function, the radar can be used as a navigation aid - (mapping).

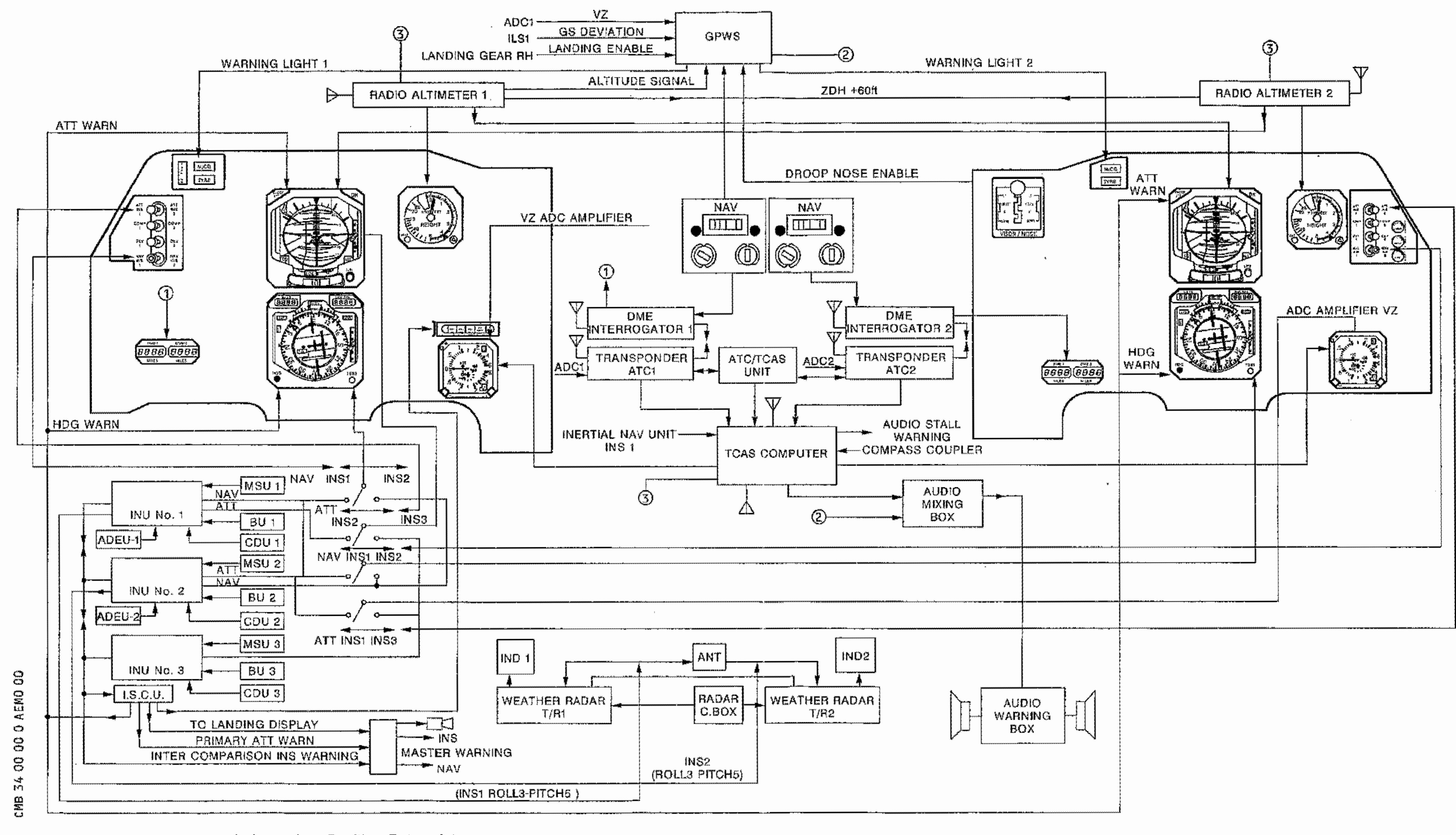
(2) Radio Altimeter

The radio altimeters consist of two independent systems which indicate radio altitude in 2 ranges, 0 to 100 ± 1 ft and 100 to 2500 ± 4% ft. In addition to altitude indicated on the two indicators, altitude information from 0 to 240 ft is also indicated by a symbol on the ADI indicators.
Altitude information is sent to the AP/FD and warning and landing display. An audio signal circuit provides an 800 Hz tone at the altitude (Decision Height + 60 ft) to the audio warning system.
R The altitude information is also transmitted to the
R TCAS computer.

(3) Inertial Navigation System (INS)

The three independent inertial navigation systems supply navigation information produced by the inertial navigation units and the computers to the relevant

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R
R Independant Position Determining
Figure 003

(3) Automatic Direction Finding (ADF)

The ADF systems display the bearing of a known station with reference to magnetic north on the two RMI/ADF indicators. The ground station operating frequency is selected by means of a dual control unit.

(4) VHF Omnirange (VOR)

The VOR systems display on the two RMI/VOR indicators indicates the bearing of the selected VOR station. The HSI indicators indicate angular deviation with reference to desired track as well as direction of flight with reference to the radial (TO or FROM). Deviation information used in guidance is also fed to the AFCS. The VOR frequencies are selected on the VOR/ILS/DME control unit.

G. Ground Proximity Warning System (GPWS) (Ref. Fig. 003)

The ground proximity warning system provides the pilots with aural (Audio Warning System) and visual (Indicator light "PULL UP") warning of potentially dangerous flight paths relative to the ground.

The GPWS receives:

- Radio altitude information from the No.1 radio altimeter
- Altitude rate information from the No.1 ADC
- Glide slope deviation signal from the No.1 ILS
- Landing gear and nose droop position signals.

R

R The GPWS provides information to the TCAS computer and
R audio mixing box.

3. Flight Compartment Preparation Check

A. LH Side Console

** On A/C 001-005,

(1) Radar indicator

- IND. OFF-LEFT-AHEAD-RIGHT in IND OFF position

** On A/C 006-007,

(1) Radar indicator

Not applicable.

B. Captain and First Officer Control Columns

(1) Pitch attitude presetting potentiometer in ZERO position.

C. Glareshield Instrument Panel, 5-211

(1) Captain and First Officer RAD/INS switch in RAD position.

(2) Captain and First Officer VOR/ILS/DME control unit in STBY position.

D. Captain's Instrument Panel

(1)	Switches ATT INS1/ATT INS3 COMP1/COMP2 DEV1/DEV2 NAV INS1/NAV INS2 FD1/FD2	in ATT INS1 position in COMP1 position in DEV1 position in NAV INS1 position in FD1 position
(2)	Vertical speed indicator	flags visible
(3)	Radio altimeter indicator	in OFF position
(4)	Standby horizon	flag visible safety pin in position
(5)	Marker - Indicator light assembly	lights off
(6)	Altimeter mode switch	in N position flags visible

Select local static pressure on window indicators.

R

R

R

R (7)	VSI TCAS Indicator	OFF
(8)	ADF/RMI	flag visible
(9)	Sideslip indicator	flag visible
(10)	HSI	flags visible
(11)	ADI	flags visible

(12)	Airspeed indicator mode switch	in N position
(13)	Machmeter	flags visible
(14)	Angle of attack and acceleration indicator	flags visible
(15)	DME1 - DME2 indicators	flags visible
(16)	VOR/RMI	flags visible
(17)	PULL-UP warning indicator light	light off
(18)	R/NAV Annunciator light	light off

E. First Officer's Instrument Panel

(1)	Switches ATT INS2/ATT INS3 COMP1/COMP2 DEV1/DEV2 NAV INS1/NAV INS2 FD1/FD2	in ATT INS2 position in COMP2 position in DEV2 position in NAV INS2 position in FD2 position
(2)	Vertical speed indicator	flags visible
(3)	Radio altimeter indicator	in OFF position
(4)	Standby horizon	flag visible safety pin in position
(5)	Marker - Indicator light assembly	lights off
(6)	Altimeter mode switch	in N position flags visible

Select local static pressure on window indicators

R
R
R

R (7)	VSI TCAS indicator	OFF
(8)	ADF/RMI	flag visible
(9)	Sideslip indicator	flag visible
(10)	HSI	flags visible

(11)	ADI	flags visible
(12)	Airspeed indicator mode switch	in N position
(13)	Machmeter	flags visible
(14)	Angle of attack and acceleration indicator	flags visible
(15)	DME1 - DME2 indicators	flags visible
(16)	VOR/RMI	flags visible
(17)	PULL-UP warning indicator light	light off
(18)	R/NAV Annunciator light	light off

F. RH Side Console

** ON A/C 001-005,

(1) Radar indicator

- IND. OFF-LEFT-AHEAD-RIGHT — in IND OFF position

** ON A/C 006-007,

(1) Radar indicator

Not applicable

(2) Panel 5-212, Radar alert switch — in OFF position

G. Flight Engineer Panel

(1)	MSU Nos. 1, 2 and 3	Mode selector switch in OFF position
(2)	Compass coupler control unit	Mode selector switch 1 and 2 in MAG position

R

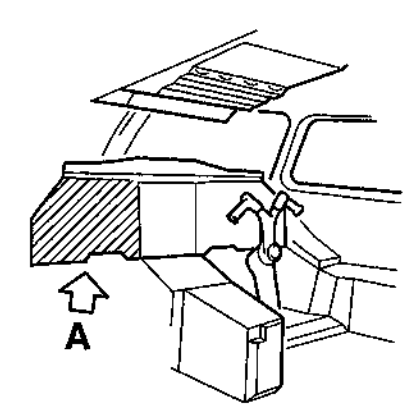
(3)	Temperature indicator	flags visible

H. Centre Console

(1)	ADC control panel	ON/OFF switch in OFF position
(2)	ATC	mode selector in STBY position

(3)	Radar	engage push-button in OFF position
(4)	Marker HI/LO switch	in LO position
(5)	CDU display selector switch	in position
(6)	ADEU	Cards not inserted into the slot.
(7)	Temperature Indicator	flags visible.

R



C

STANDBY AIR SPEED/MACH INDICATOR

- FIXED SCALE 100 TO 650 kt
- MOVING SCALE 0.4 TO 2.5 MACH
- WHITE AIR SPEED/MACH NO. POINTER
ABOVE 250kt THE MACH NO. IS READ ON THE MOVING SCALE AGAINST THE AIR SPEED POINTER
- CHECKERED POINTER DISPLAYS VMO
- REFERENCE BUG CONTROLLED BY RH KNOB
- 4 MANUALY POSITIONED REMINDER BUGS ON INSTRUMENT BEZEL

D

MACHMETER

- COUNTER DISPLAYS MACH NUMBER
- WHITE POINTER INDICATES MACH NUMBER
- CHECKERED POINTER INDICATES MMO
- AFT AND FWD INDICES INDICATE MIN AND MAX MACH NO. ACCORDING TO THE CENTRE OF GRAVITY

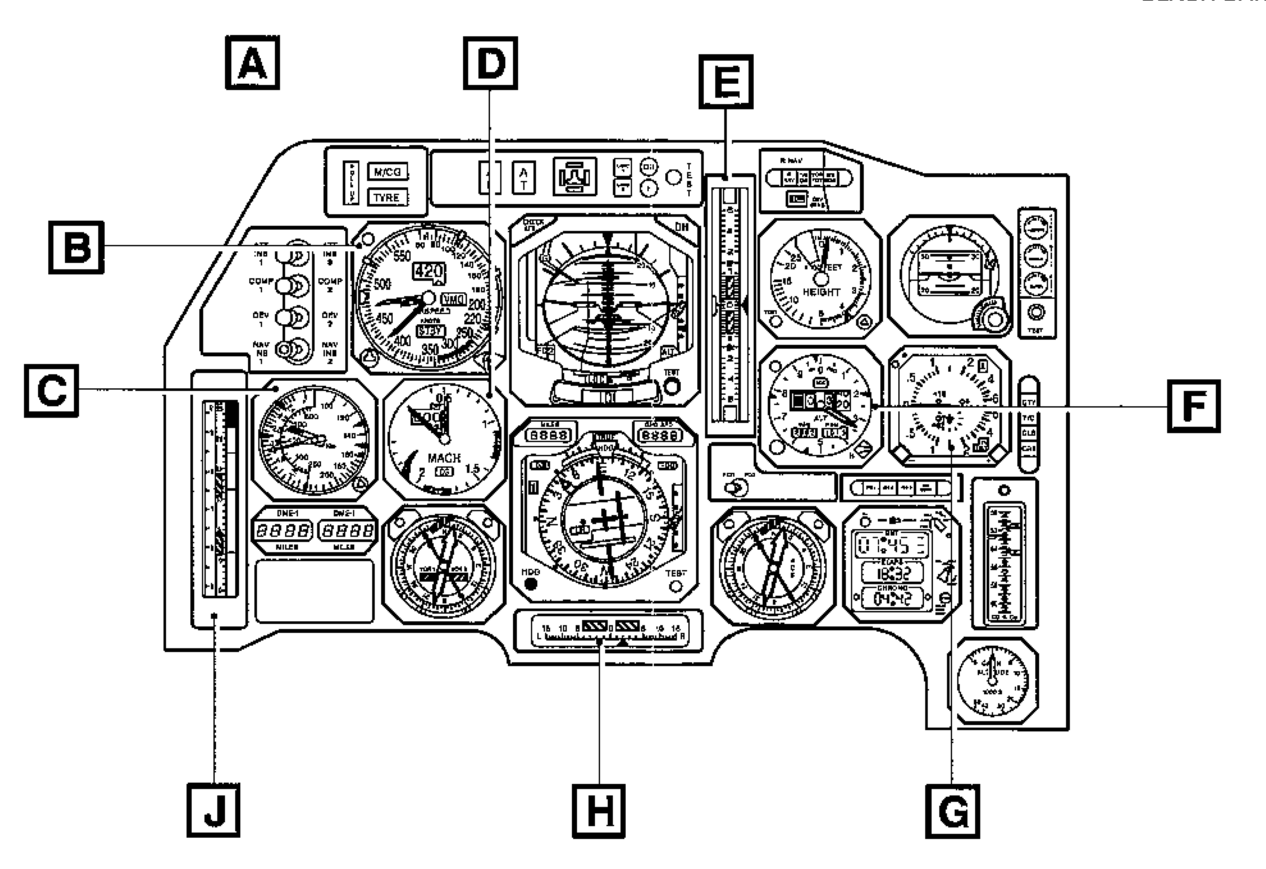
WARNINGS:
- FIRE ORANGE AND BLACK STRIPED FLAG AT LOWER LEFT
- FIRE ORANGE CG FLAG IN LOWER CENTRE WINDOW
- BLACK BAR MASKING COUNTER

B

AIR SPEED INDICATOR

2 MODES OF OPERATION, NORMAL OR STANDBY.
N OR S REPEATED IN WINDOW ABOVE SELECTOR.
NORMAL MODE: ADC SYNCHRO INFORMATION.
STANDBY MODE: BAROMETRIC Pt AND Ps INFORMATION.
- WHITE POINTER INDICATES Vc
- AIRSPEED COUNTER DISPLAYS Vc
- CHECKERED POINTER INDICATES VMO
- T-SHAPED REMINDER BUG CONTROLLED BY LH KNOB
- 4 MANUALLY POSITIONED BUGS ON INSTRUMENT BEZEL

WARNINGS:
- FIRE ORANGE 'OFF' FLAG IN WINDOW
- AMBER LIGHT AT UPPER LEFT INDICATES DISCREPANCY BETWEEN INDICATED AIR SPEED AND AUTOTHROTTLE SELECTED AIR SPEED > 10kt



E

VERTICAL SPEED INDICATOR

- FIXED COMMON SCALE 0 TO ± 6000ft/min
- 2 WINDOWS DISPLAY VERTICAL SPEED BEYOND FIXED SCALE LIMITS
- WHITE COMMAND SPEED BUG ON LEFT OF INSTRUMENT
- YELLOW REAL VERTICAL SPEED POINTER ON RIGHT OF INSTRUMENT

2 MODES OF OPERATION, NORMAL OR COMMAND VIA AFCS DATUM ADJUST CONTROL.
- NORMAL: COMMAND SPEED BUG IS SLAVED TO RH REAL VERTICAL SPEED POINTER, REFERENCED TO THE ADC
- COMMAND: (HOLDING OR SELECTING COMMANDED VALUE) THE COMMAND SPEED POINTER IS SLAVED TO THE AFCS DATUM ADJUST. THE AFCS ACTS TO RETURN THE REAL VERTICAL SPEED TO THE COMMAND VALUE

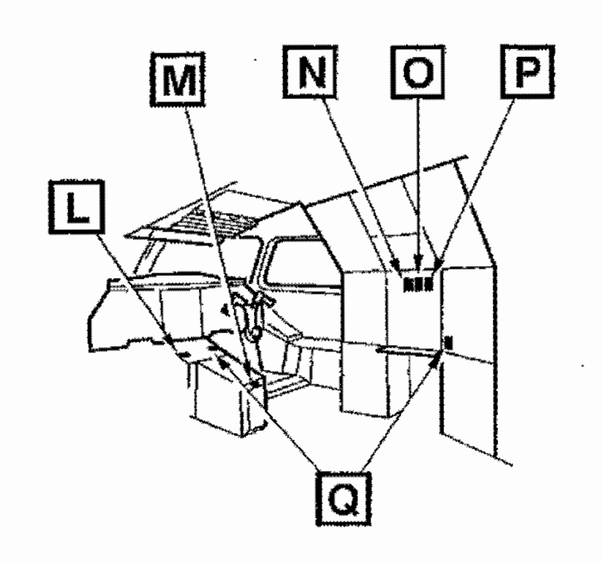
WARNINGS:
- 2 ALARM FLAGS, FIRE ORANGE AND BLACK STRIPED ONE EACH SIDE OF THE FIXED ZERO POINT

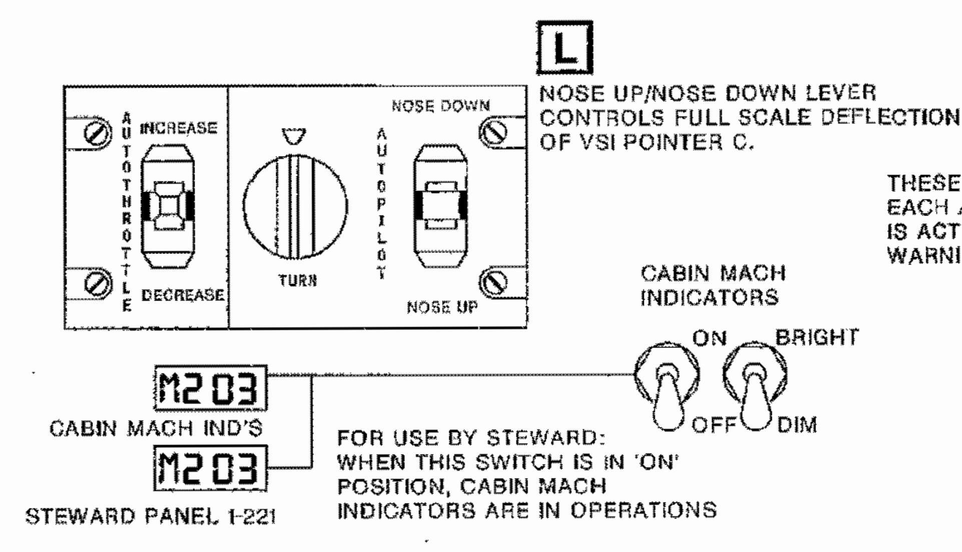
NOTE: FOR ITEMS F,G, H, J SEE SHT 2/4

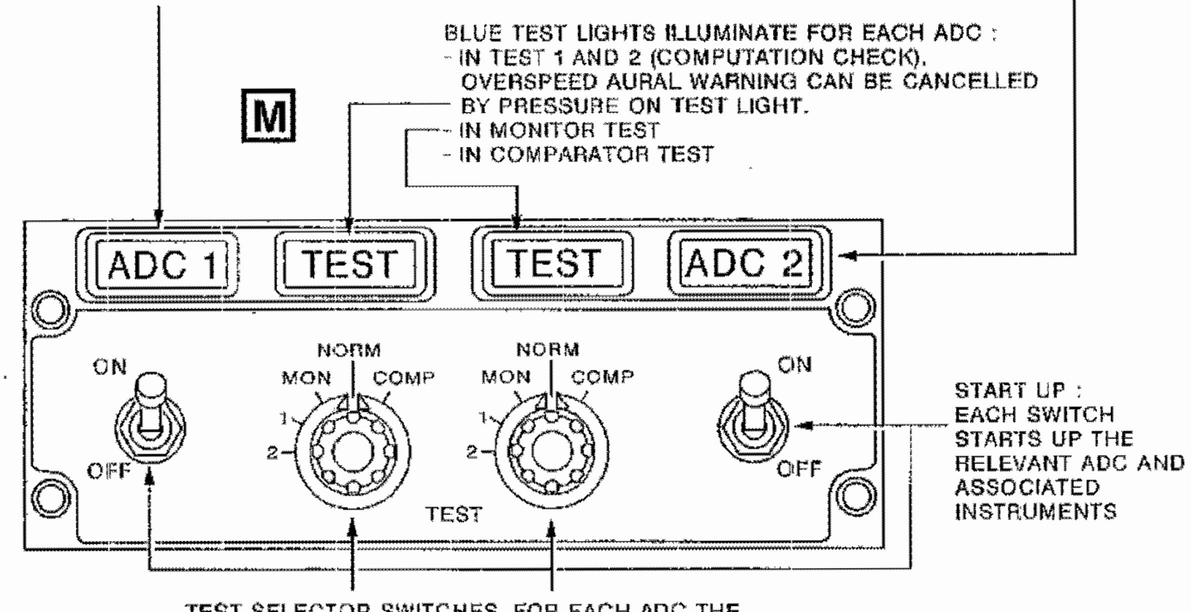
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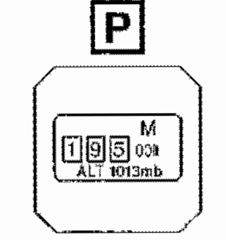
Air Data System Management (Captain's Dash Panel)(Sheet 1/4)

Figure 004





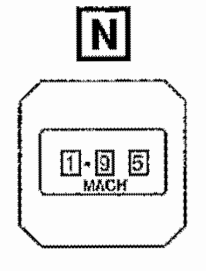




ALTIMETER DIGITAL

A DIGITAL COUNTER WITH 3 DRUMS AND TWO ZEROs AT THE RIGHT ARE FIXED.
- THE RH DRUM INDICATES HUNDREDS OF FEET.
- THE CENTRE DRUM INDICATES THOUSANDS OF FEET.
- THE LH DRUM INDICATES TENS OF THOUSANDS OF FEET OR THE - SIGN FOR NEGATIVE ALTITUDES OR BLACK AND WHITE DIAGONALLY STRIPED ZONE FOR ALTITUDES BETWEEN 0 AND - 10000ft.

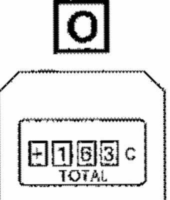
WARNING:
- A BLACK FLAG WITH FIRE ORANGE DIAGONAL STRIPES MASKS THE DRUMS.



MACHMETER DIGITAL

A DIGITAL COUNTER WITH 3 DRUMS
- THE RH DRUM INDICATES HUNDREDTHS OF MACH.
- THE CENTRE DRUM INDICATES TENTHS OF MACH.
- THE LH DRUM INDICATES UNITS OF MACH.

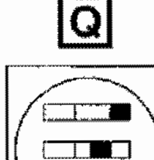
WARNING:
- A BLACK FLAG WITH FIRE ORANGE DIAGONAL STRIPES MASKS THE DRUMS.



TOTAL TEMPERATURE INDICATOR

A DIGITAL COUNTER:
- THE DRUMS INDICATING FROM RIGHT TO LEFT: UNITS, TENS AND HUNDREDS OF °C, + OR -.

WARNING:
- BLACK FLAG WITH FIRE ORANGE DIAGONAL STRIPES MASKS THE DRUMS.



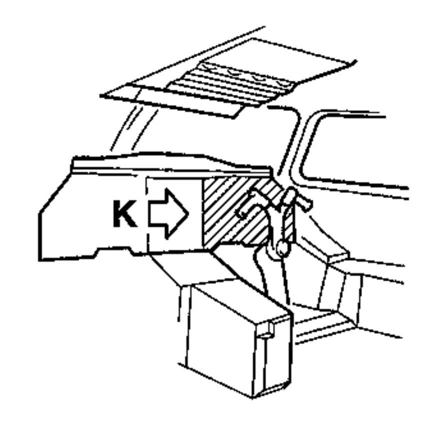
TEMPERATURE INDICATOR

THREE COUNTERS DISPLAY
- TOTAL
- STATIC
- INTERNATIONAL STANDARD ATMOSPHERE
- TMO (IN RED) 'MAX' ALLOWABLE TEMP.

WARNINGS:
3 FLAGS TO LEFT OF COUNTERS MARKED TOTAL , STATIC, ISA BLACK ON ORANGE GROUND.

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R Air Data System Management (Sheet 3/4)
R Figure 004



G
VSI TCAS INDICATOR (REF.FIG.015)

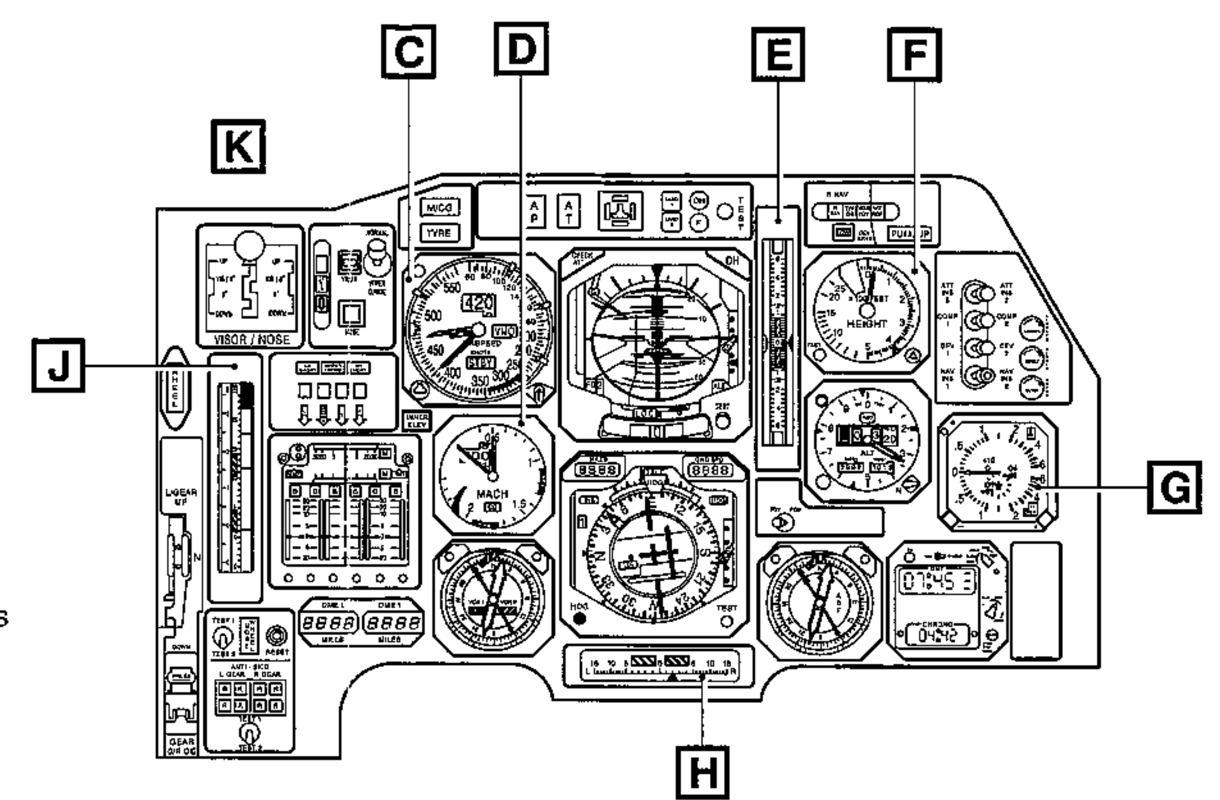
H
SIDESLIP INDICATOR

POINTER DISPLACEMENT INDICATES ANGLE OF SIDESLIP IN DEGREES L OR R
WARNING:
2 RED AND BLACK STRIPED FLAGS

F
ALTIMETER

2 MODES OF OPERATION, NORMAL OR STANDBY.
N OR S REPEATED IN WINDOW ADJACENT TO SELECTOR.
MODE REPEATED IN CENTRE WINDOW ABOVE COUNTERS.
NORMAL MODE: ADC SYNCHRO INFORMATION.
STANDBY MODE: BAROMETIC Ps INFORMATION.
- ALTITUDE POINTER INDICATES ALTITUDE IN HUNDREDS OF FEET
- A 4-DRUM ALTITUDE READING TENS OF THOUSANDS, THOUSANDS, HUNDREDS AND TWENTIES OF FEET. AT ALTITUDES BELOW 10,000ft, THE LH DRUM DISPLAYS BLACK AND WHITE STRIPES. AT NEGATIVE ALTITUDES, THE LH DRUM DISPLAYS FIRE ORANGE AND WHITE STRIPES AND IN ADDITION, A WHITE AND YELLOW FLAG PARTLY MASKS THE COUNTER
- 2 WINDOWS DISPLAYING DATUM PRESSURE SETTING IN in Hg AND mb CONTROLLED BY LH KNOB
- 4 MANUALLY POSITIONED REMINDER BUGS ON INSTRUMENT BEZEL

WARNINGS:
- A WHITE AND YELLOW STRIPED FLAG MASKS THE LOWER PART OF THE COUNTERS
- A BLACK AND FIRE ORANGE STRIPED FLAG MASKS THE UPPER PART OF THE COUNTERS
- AN AMBER ALTITUDE ALERT LIGHT AT UPPER LEFT ILLUMINATES WHEN INDICATED ALTITUDE APPROACHES WITHIN 1200ft OF THE ALTITUDE SELECTED ON THE AFCS CONTROLLER. THE LIGHT WILL EXTINGUSH ON CAPTURE OF SELECTED ALTITUDE ±300ft. IF, AFTER SELECTED ALTITUDE CAPTURE, INDICATED ALTITUDE DEVIATES BY MORE THAN 300ft FROM SELECTED ALTITUDE, THE ALERT LIGHT WILL FLASH



J
ANGLE OF ATTACK

THE ANGLE OF ATTACK VALUE $\propto$ IS INDICATED BY A MOVING RIBBON AGAINST A FIXED SCALE
WARNING:
2 FIRE ORANGE AND BLACK STRIPED FLAGS APPEAR

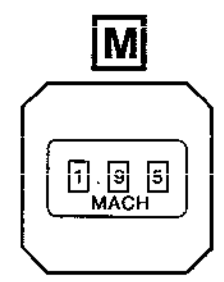
J
ACCELERATION

THE g VALUE IS INDICATED BY A POINTER AGAINST A FIXED SCALE

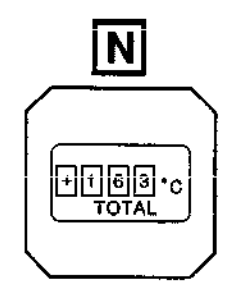
NOTE: FOR ITEMS C, D, E, SEE SHEET 1/4

Air Data System Management (First Officer's Dash Panel)(Sheet 2/4)

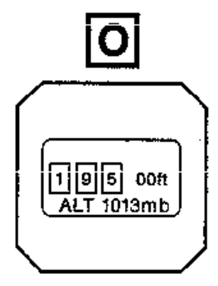
Figure 004



MACHMETER DIGITAL
A DIGITAL COUNTER WITH 3 DRUMS :
- THE RH DRUM INDICATES HUNDREDTHS OF MACH.
- THE CENTRE DRUM INDICATES TENTHS OF MACH.
- THE LH DRUM INDICATES UNITS OF MACH.
WARNING :
- A BLACK FLAG WITH FIRE ORANGE DIAGONAL STRIPES MASKS THE DRUMS.



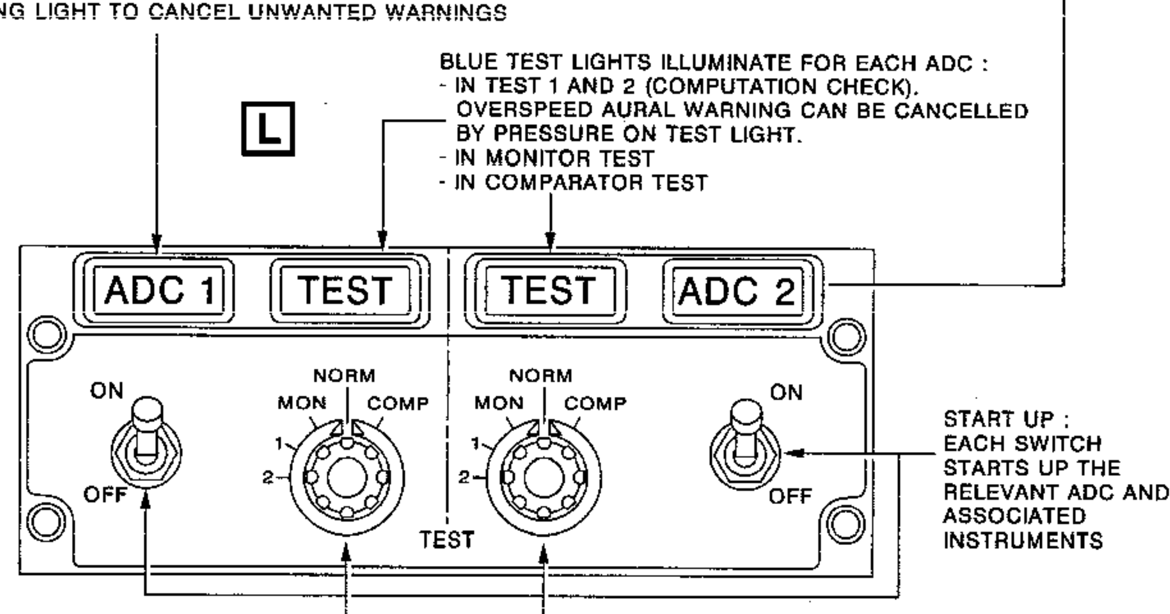
TOTAL TEMPERATURE INDICATOR
A DIGITAL COUNTER :
- THE DRUMS INDICATING FROM RIGHT TO LEFT : UNITS, TENS AND HUNDREDS OF °C.
- THE LH DRUM INDICATES SIGN + OR - .
WARNING:
- A BLACK FLAG WITH FIRE ORANGE DIAGONAL STRIPES MASKS THE DRUMS.



ALTIMETER DIGITAL
A DIGITAL COUNTER WITH 3 DRUMS AND TWO ZEROs AT THE RIGHT ARE FIXED.
- THE RH DRUM INDICATES HUNDREDS OF FEET.
THE CENTRE DRUM INDICATES THOUSANDS OF FEET.
- THE LH DRUM INDICATES TENS OF THOUSANDS OF FEET OR THE - SIGN FOR NEGATIVE ALTITUDES OR BLACK AND WHITE DIAGONALLY STRIPED ZONES FOR ALTITUDES BETWEEN 0 AND +10000 FT.
WARNING :
- A BLACK FLAG WITH FIRE ORANGE DIAGONAL STRIPES MASKS THE DRUMS.

THESE AMBER WARNING LIGHTS ILLUMINATE FOR EACH ADC WHEN A COMPUTER GENERAL WARNING IS ACTUATED OR DURING MONITOR TEST. PRESS WARNING LIGHT TO CANCEL UNWANTED WARNINGS

BLUE TEST LIGHTS ILLUMINATE FOR EACH ADC :
- IN TEST 1 AND 2 (COMPUTATION CHECK). OVERSPEED AURAL WARNING CAN BE CANCELLED BY PRESSURE ON TEST LIGHT.
- IN MONITOR TEST
- IN COMPARATOR TEST



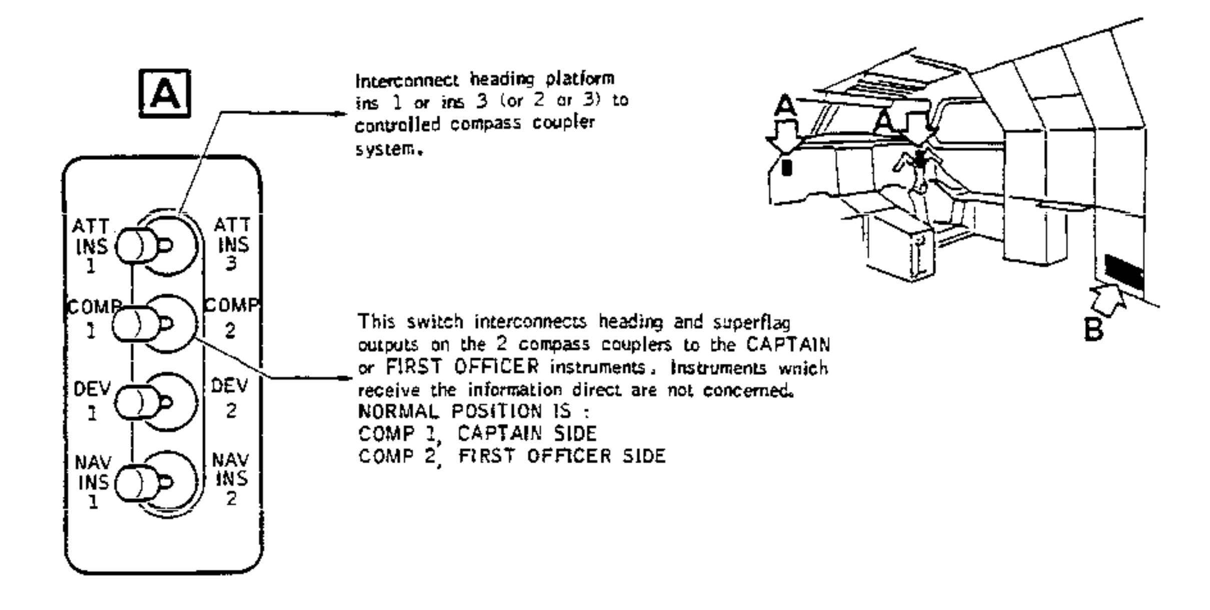
START UP :
EACH SWITCH STARTS UP THE RELEVANT ADC AND ASSOCIATED INSTRUMENTS

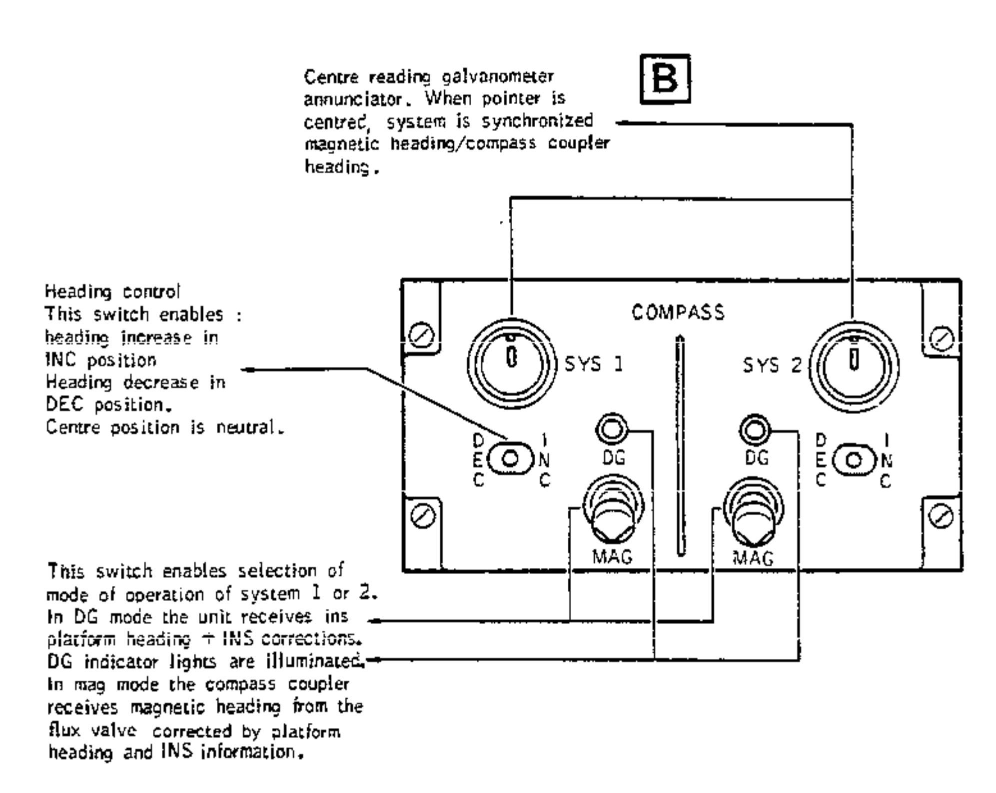
TEST SELECTOR SWITCHES. FOR EACH ADC THE SELECTOR ACTIVATES :
COMP : CHECK OF COMPARISON CIRCUITS
NORM : NORMAL OPERATION, SELF TEST INOPERATIVE.
MON : MONITOR CIRCUIT CHECK
TEST 1 : SUBSONIC FLIGHT CONDITION SIMULATION CONTROL
TEST 2 : SUPERSONIC FLIGHT CONDITION SIMULATION CONTROL
NOTE : THE LAST 3 TESTS ARE INHIBITED IN FLIGHT.

CMB 34 00 00 0 AGMU 00

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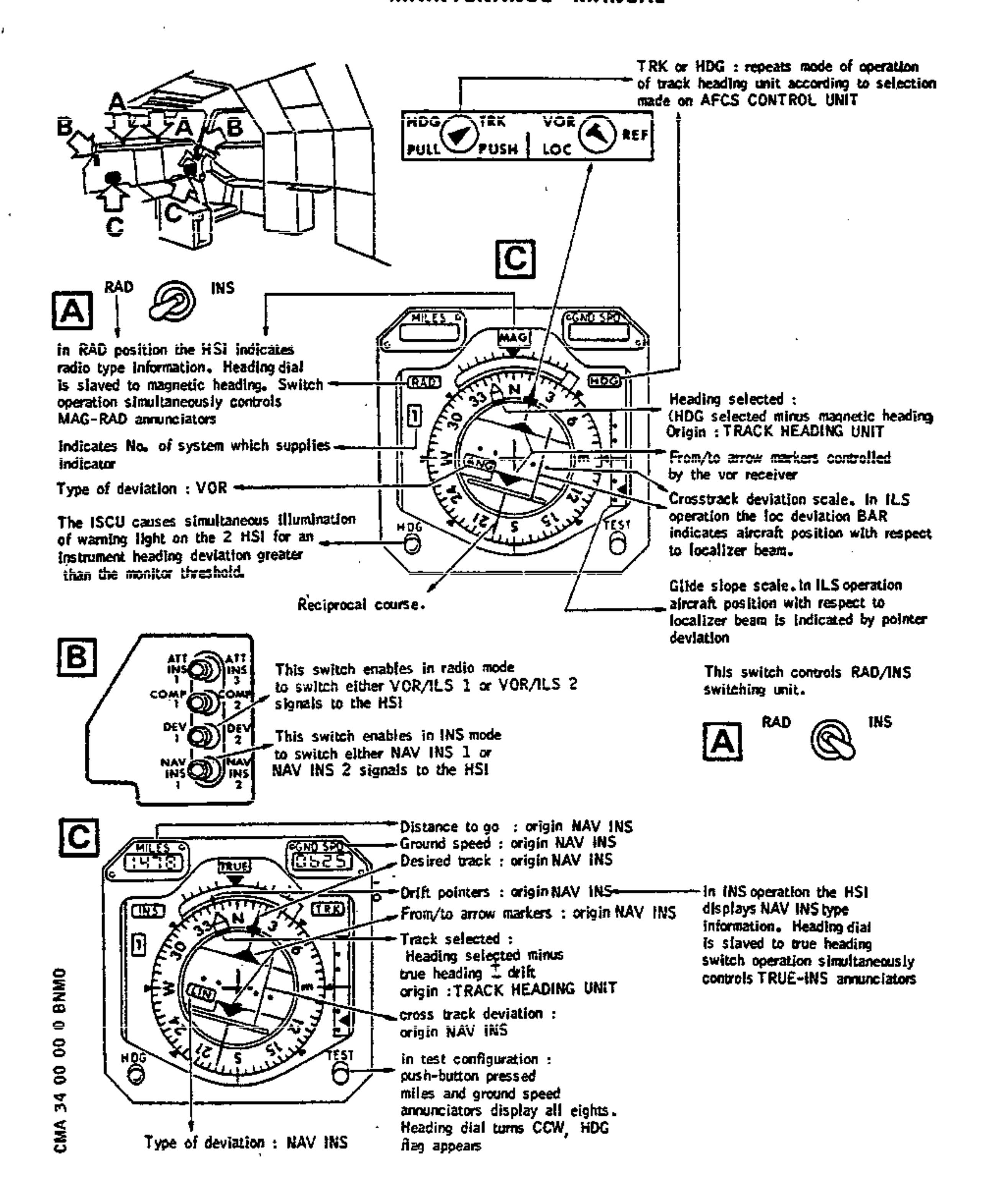
R Air Data System Management (Sheet 4/4)
R Figure 004



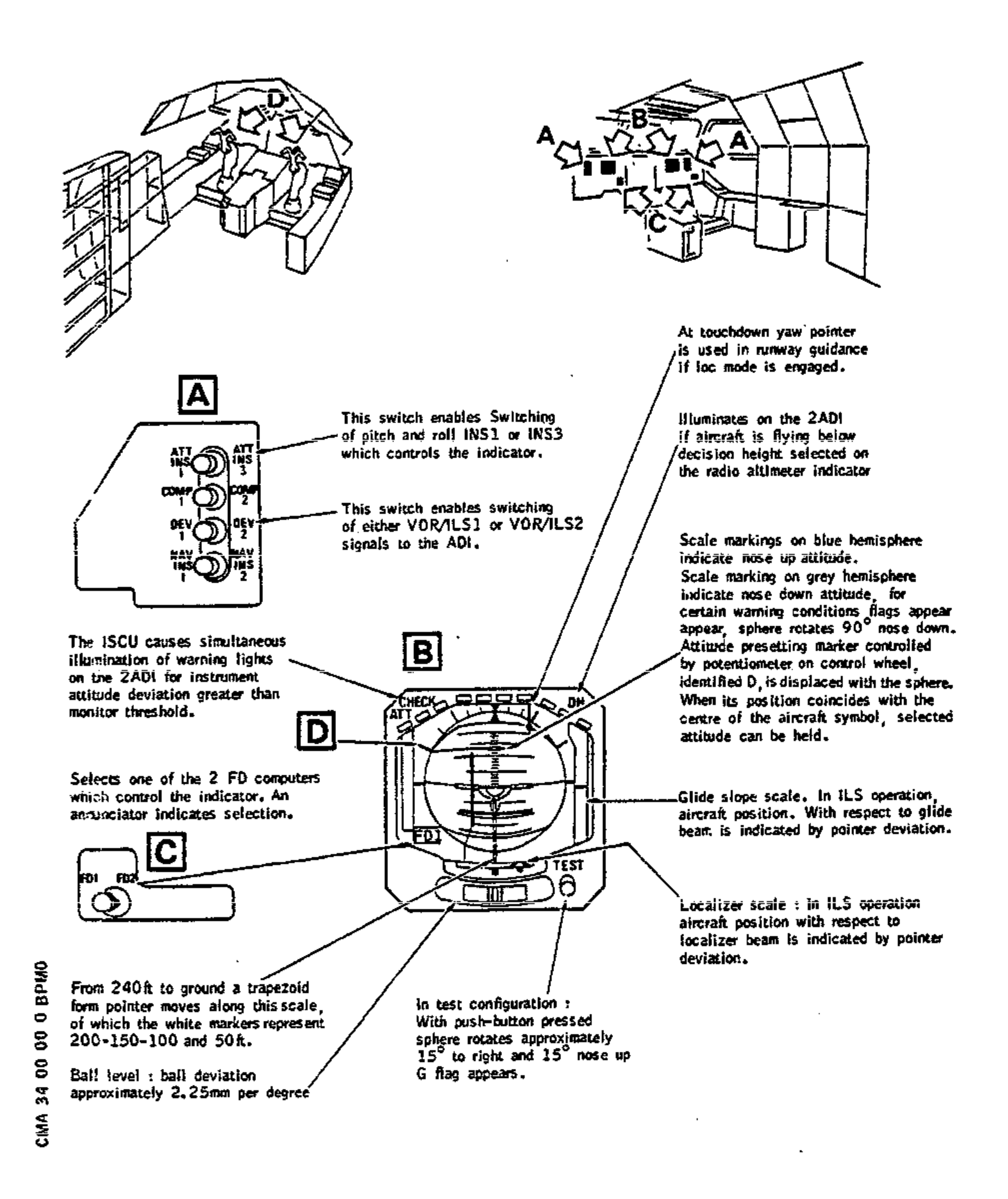


CMA 34 00 00 0 BLMO

Compass Coupler System Management
Figure 005



HSI System Management
Figure 006

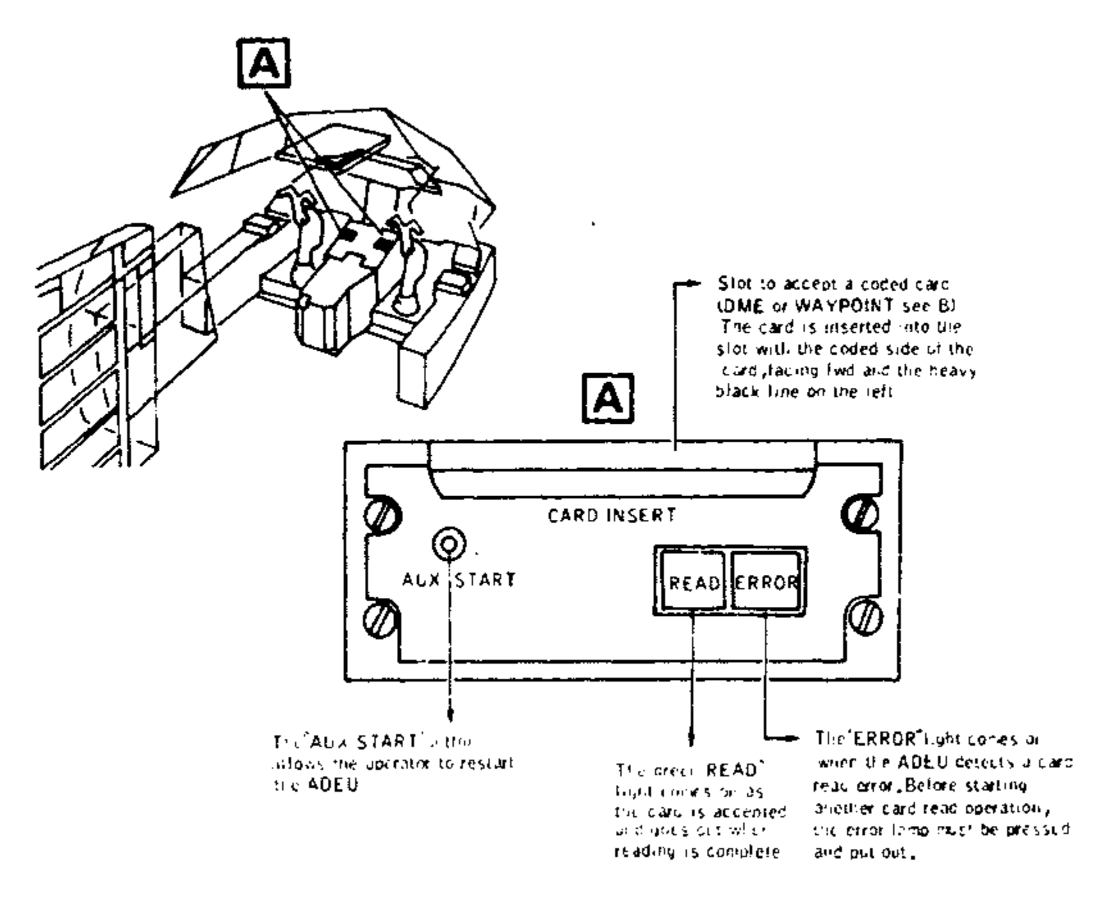


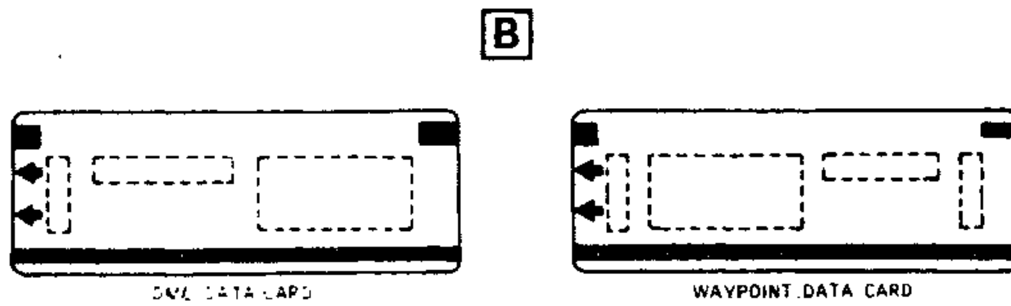
ADI System Management
Figure 007

EFFECTIVITY: 001-005

BA

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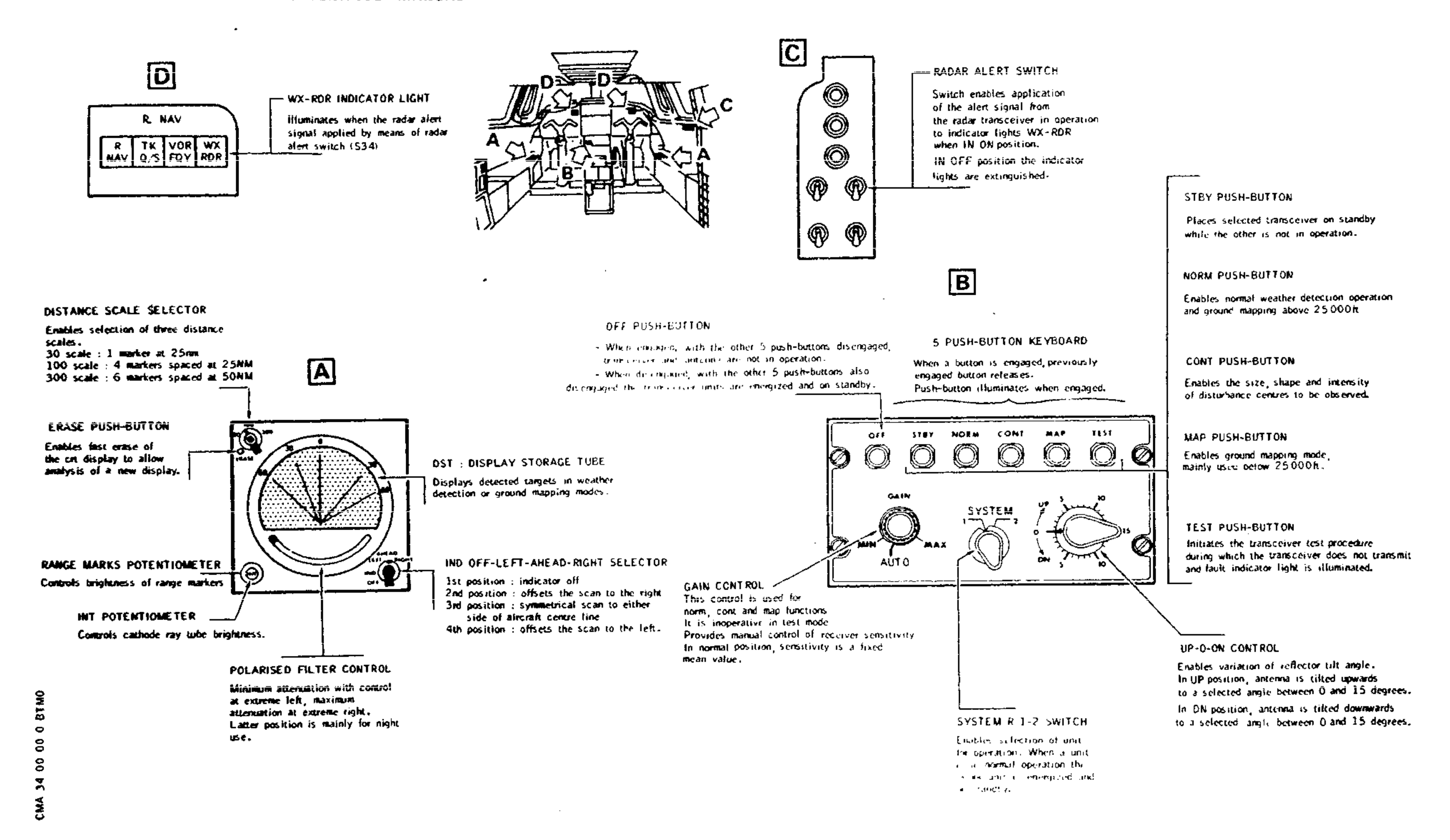


CMA 34 00 00 0 BSMO

INS - ADEU System Management
Figure 009

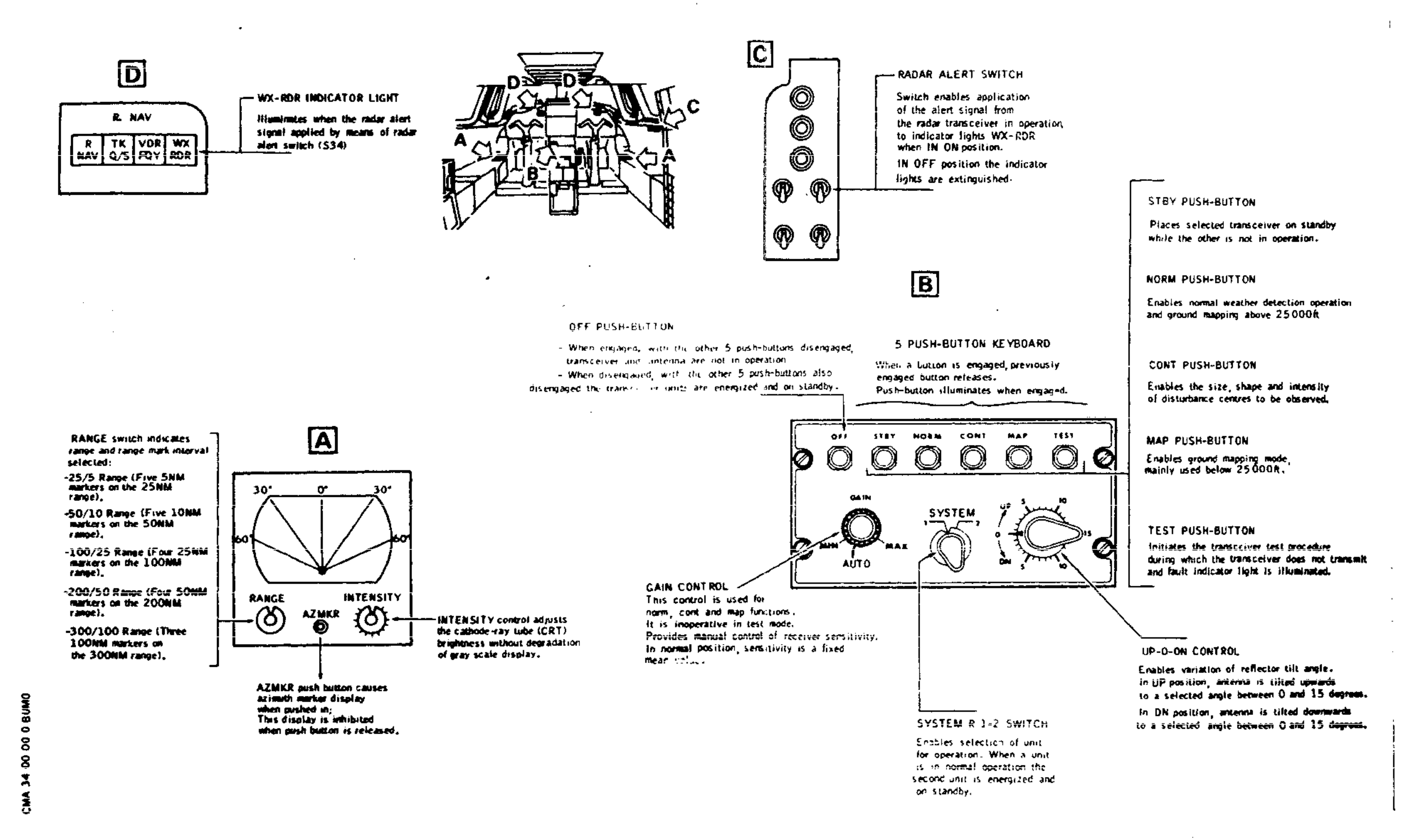
R

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CMA 34 00 00 0 BTMO

Weather Radar System Management
Figure 010



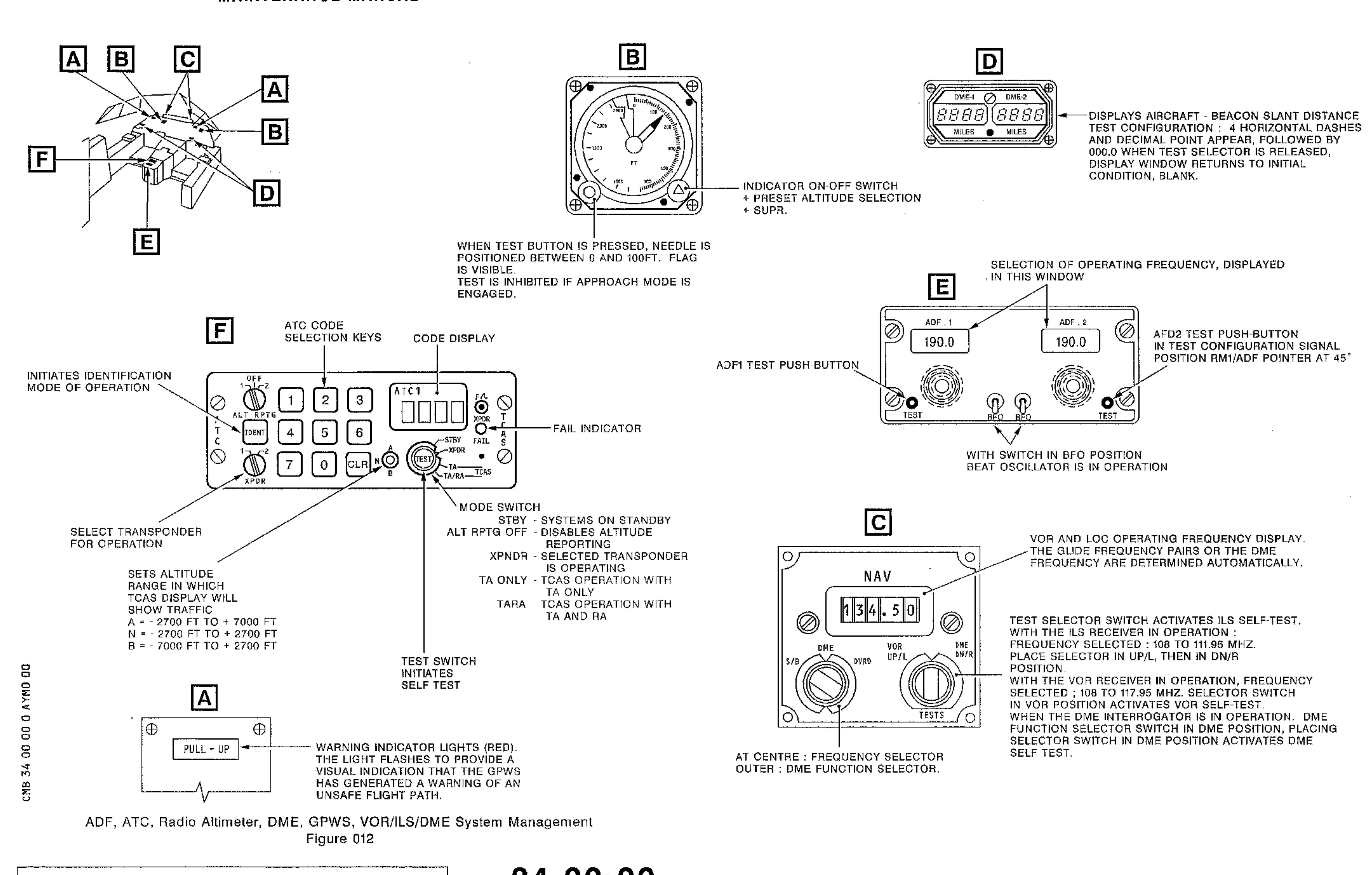
CMA 34 00 00 0 BUM0

Weather Radar System Management
Figure 011

R
R EFFECTIVITY: 006-007,

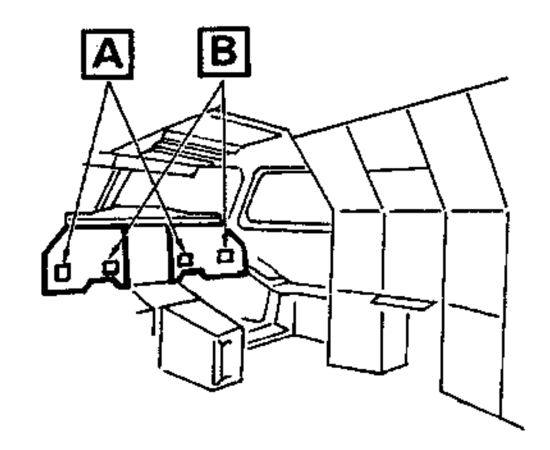
BA

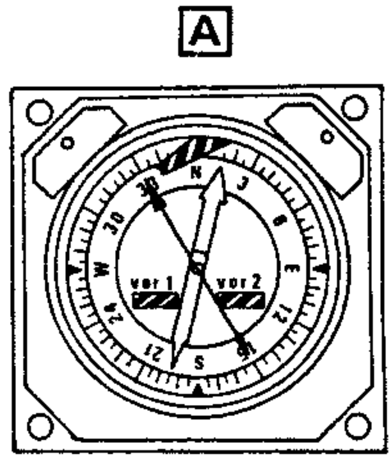
Printed in England



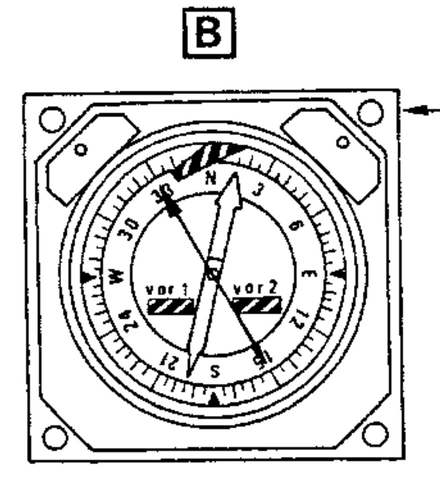
CMB 34 00 00 0 AYM0 00

R
R ADF, ATC, Radio Altimeter, DME, GPWS, VOR/ILS/DME System Management
Figure 012





RMI/VOR INDICATOR
The aircraft magnetic heading is read on compass card graduated in five degree increments.
The card is marked with numerical indications at thirty degree intervals and N,E,S,W indications at ninety degree intervals
The bearings are indicated by two needles moving around of the compass card:
-The single needle corresponds to VOR1 bearings.
-The double needle corresponds to VOR2 bearings.
WARNINGS:
-In case of malfuntion,a compass warning black flag with fire orange diagonal stripes appears in the upper part of the indicator.
-Two black flags (VOR1-VOR2) with fire orange diagonal stripes appears when the indicator or VOR receiver warning voltages are produced

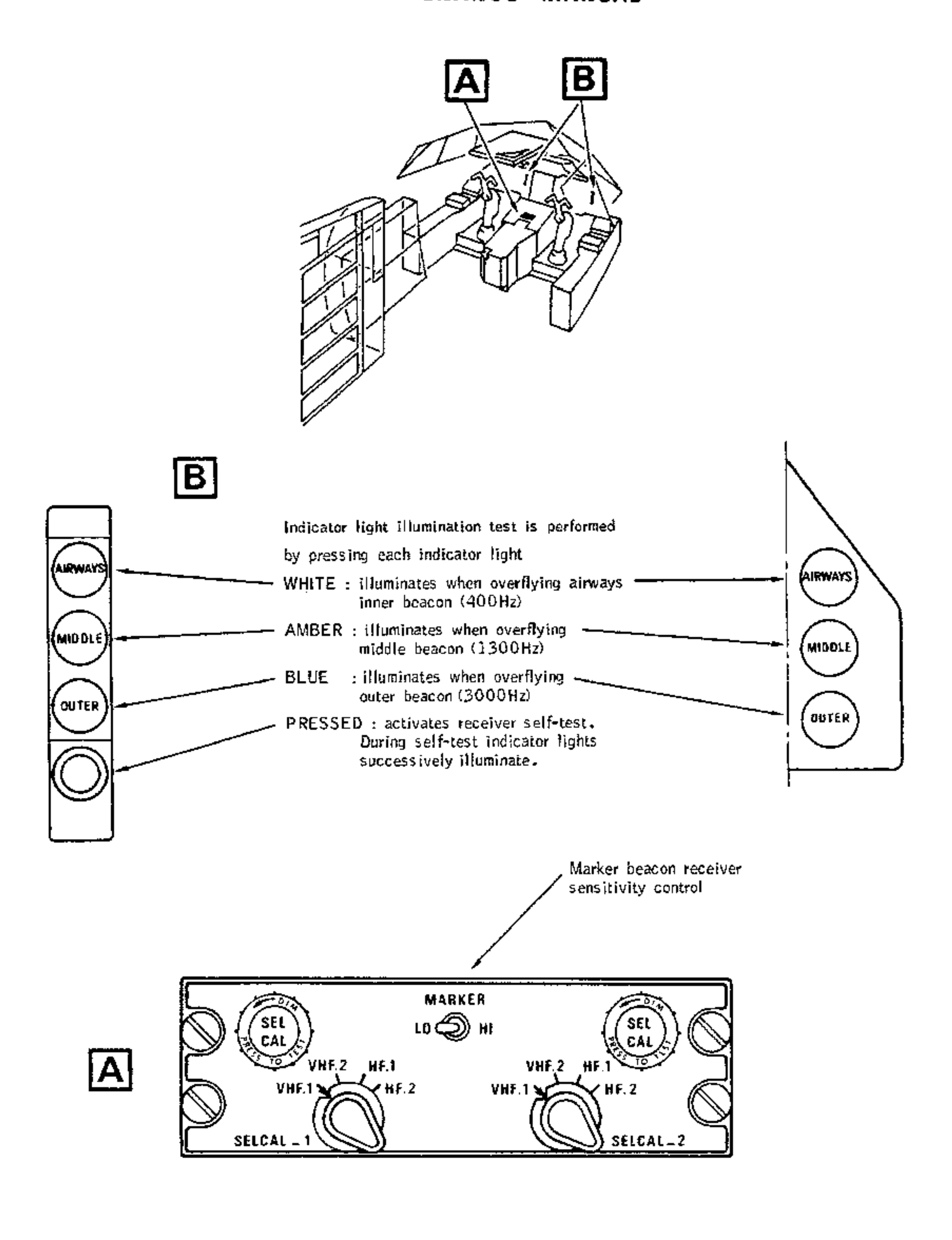


RMI/ADF INDICATOR
The aircraft magnetic heading is read on compass card graduated in five degree increments.
The card is marked with numerical indications at thirty degree intervals and N,E,S,W indications at ninety degree intervals.
The bearings are indicated by two needles moving around of the compass card:
-The single needle corresponds to ADF1 bearings
-The double needle corresponds to ADF2 bearings
WARNING:
-In case of malfunction,a compass warning black flag with fire orange diagonal stripes appears in the upper part of the indicator

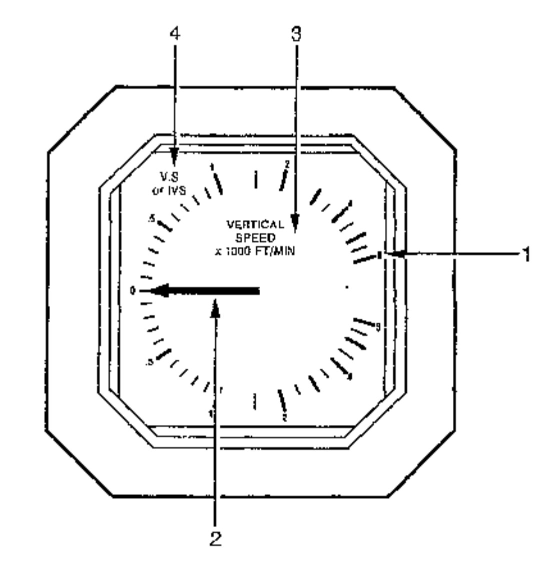
CMA 34 00 00 0 BXMO

RMI indicators ADF/VOR System Management
Figure 013

R

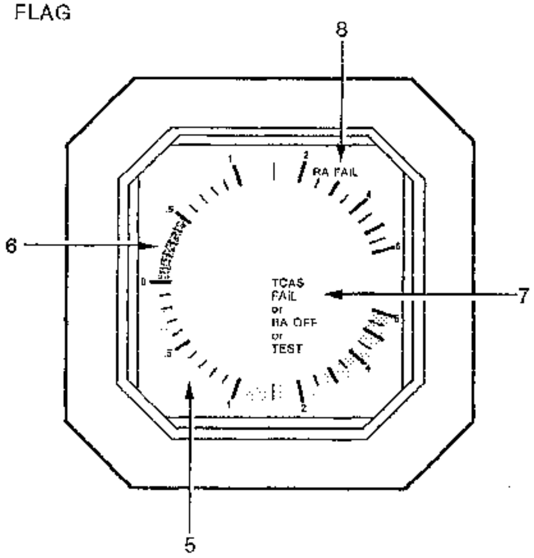


Marker Beacon System Management
Figure 014



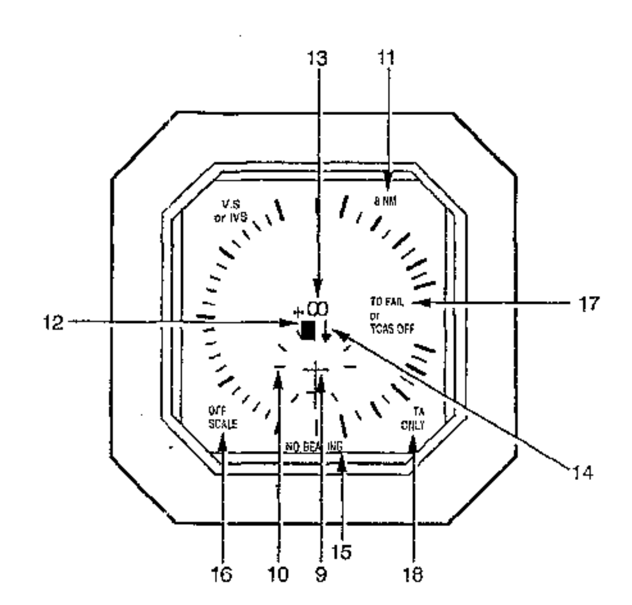
VERTICAL SPEED FUNCTION (VSI MODE)

1. VERTICAL SPEED SCALE GRADUATED FROM +6000 TO - 6000 FT/MN
2. VERTICAL SPEED POINTER
3. VERTICAL SPEED LEGEND
4. VERTICAL SPEED FAILURE WARNING FLAG V/S OR IVS OPERATING FLAG



RESOLUTION ADVISORY FUNCTION (RA/VSI OR RA - TA VSI MODE)

5. RED ARC LOCATED ALONG THE VERTICAL SPEED SCALE AND USED TO DISPLAY PROHIBITED VERTICAL SPEEDS
6. "FLY TO" GREEN ARC ATTACHED TO THE RED ARC FOR CORRECTIVE ADVISORIES
7. TCAS FAIL FLAG OR RA OFF FLAG OR TEST FLAG
8. RA FAIL FLAG



TRAFFIC FUNCTION (TA - RA/VSI MODE)
FIXED SYMBOLOGY

9. OWN AIRCRAFT SYMBOL. THE INTERSECTION OF THE VERTICAL LINE AND UPPER HORIZONTAL LINE GIVES THE REFERENCE POINT FOR THE DISTANCES DISPLAYED (4 NM AT THE FRONT AND 2.5 NM AT THE BACK FOR THE BASIC CONFIGURATION).
10. RANGE RING. THE CENTRE OF EACH OF THE TWELVE CLOCKWISE MARKS IS LOCATED ON THE CIRCLE WITH A RADIUS OF 2 NM FOR THE BASIC CONFIGURATION.
11. SELECTED RANGE DISPAY.

INTRUDER SYMBOLOGY

12. SYMBOL FOR DISPLAYING AN INTRUDER. ITS POSITION IN RELATION TO THE CENTRE OF THE OWN AIRCRAFT SYMBOL GIVES ITS DISTANCE AND BEARING. FOUR SYMBOLS ARE USED TO IDENTIFY THE TYPE OF INTRUDER.

■ RESOLUTION ADVISORY (RA) SYMBOL (RED FILLED SQUARE).
● TRAFFIC ADVISORY (TA) SYMBOL (YELLOW FILLED CIRCLE).
◆ PROXIMATE TRAFFIC SYMBOL (CYAN FILLED DIAMOND).
◇ NO THREAT (OTHER) SYMBOL (CYAN DIAMOND OUTLINED).

13. ALTITUDE TAG. THE DISPLAY IS AS FOLLOWS
RELATIVE ALTITUDE - TWO UNSIGNED (±) DIGITS
ACTUAL ALTITUDE - THREE DIGITS
CO - ALTITUDE - TWO ZERO'S
THE UNIT IS HUNDREDS OF FEET
14. VERTICAL DIRECTION ARROW INDICATES THE RELATIVE VERTICAL SPEED OF THE INTRUDER. THE DISPLAY IS AS FOLLOWS :
NO VERTICAL RATE - NO ARROW
CLIMBING - ARROW POINTS UPWARDS
DECENDING - ARROW POINTS DOWNWARDS
15. "NO BEARING" INTRUDER. THE POSITIONING OF THE SYMBOL (TA AND RA SYMBOLS ONLY) IS NOT POSSIBLE BUT IS REPLACED BY A "NO BEARING" MESSAGE. EXAMPLE : TA 15.0 + 41.
16. OFF SCALE MESSAGE. THE RA OR TA INTRUDER IS OUTSIDE THE DISPLAY RANGE SCALE.
17. TD FAIL FLAG (FAILURE IN THE TRAFFIC FUNCTION ONLY) OR TCAS OFF MESSAGE.
18. TA ONLY MESSAGE. THIS MESSAGE IS CONTINUOUSLY DISPLAYED IF THE TCAS COMPUTER IS IN A SPECIAL OPERATING MODE. THE MESSAGE IS DISPLAYED IN BLACK LETTERS ON A WHITE BACKGROUND IN NORMAL OPERATION AND A YELLOW BACKGROUND WHEN TA INTRUDER IS DETECTED.

CMB 34 00 00 0 BEMO 00

R
R VSI/TCAS Indicator Systems Management
Figure 015

5. Electrical Power

The navigation systems are supplied with electrical power from busbars :
28VDC supply from essential and normal busbars.
115VAC supply from essential and normal busbars.
A special standby battery supply for the INS systems is automatically switched in case of a failure the AC power supply after the INS start-up phase.

CIRCUIT BREAKER	SERVICE	PANEL	BUSBAR
F36	1ST PLT ACCELMTR TX SUP	2-213	14XS ESSENTIAL 26VAC
1F88	1ST PLT ALT ASI STBY IND	2-213	32X STBY 26VAC
1F75	1ST PLT ADC INST SUP	2-213	14X ESSENTIAL 26VAC
1F97	1ST PLT VSI SUP	2-213	14X NORMAL 26VAC
1F73	ADC1 115VAC SUP	2-213	6X ESSENTIAL 115VAC
1F78	ADC1 26VAC SUP	2-213	14X ESSENTIAL 26VAC
1F74	ADC1 28VDC SUP	1-213	3P ESSENTIAL 28VDC
F37	2ND PLT ACCELMTR TX SUP	13-216	13XS NORMAL 26VAC
2F88	2ND PLT ALT ASI STBY IND	2-213	32X STBY 26VAC
2F75	2ND PLT ADC INST SUP	13-216	13XS NORMAL 26VAC
2F97	2ND PLT VSI SUP	13-216	13X NORMAL 26VAC
F105	3CM ADC TEMP INST SUP	13-216	13XS NORMAL 26VAC
2F73	ADC2 115VAC SUP	13-216	11X SHEDDABLE 115VAC
2F78	ADC2 26VAC SUP	13-216	13X NORMAL 26VAC
2F74	ADC2 28VDC SUP	5-213	4P ESSENTIAL 28VDC
2C17	AP/FD SYS2 CONT	5-213	4P ESSENTIAL 28VDC
1C17	AP/FD SYS1 CONT	1-213	3P ESSENTIAL 28VDC
1C181	AT SYNCHRO SYS1 SUP	13-215	12X NORMAL 26VAC
R 2C181	AT SYNCHRO SYS2 SUP	13-216	13X NORMAL 26VAC
1F134	COMPASS COUPLER SYS1 SW SUP	1-213	3P ESSENTIAL 28VDC
1F130	COMPASS COUPLER 1 SUP	2-213	6X ESSENTIAL 115VAC
2F131	COMPASS COUPLER 2 STBY SUP	13-215	10X SHEDDABLE 115VAC
2F130	COMPASS COUPLER NORM SUP	13-216	11X SHEDDABLE 115VAC
2F134	COMPASS COUPLER SYST2 SUP	15-216	2P NORMAL 28VDC
1C20	AP/FD SYST1 SUP	2-213	12X NORMAL 26VAC
2C20	AP/FD SYST2 SUP	13-216	13X NORMAL 26VAC
1F21	HSI TRUE 1ST PLT INS1 SUP & IND	2-213	14XS ESSENTIAL 26VAC
1F16	HSI MAG 1ST PLT INS1 SUP & IND	2-213	14X ESSENTIAL 26VAC
2F21	HSI TRUE 2ND PLT INS2 SUP & IND	13-216	13XS NORMAL 26VAC
2F16	2ND PLT INS2 SUP & IND	13-216	13X NORMAL 26VAC

CIRCUIT BREAKER	SERVICE	PANEL	BUSBAR
1R34	RMI VHF NAV1 IND	2-213	14XS ESSENTIAL 26VAC
2R34	RMI VHF NAV2 IND	13-216	13XS NORMAL 26VAC
F121	STBY HORIZON IND	1-213	3P ESSENTIAL 28VDC
R47	MARKER SUP	3-213	4P ESSENTIAL 28VDC
1R33	VOR VHF NAV1 SUP	2-213	6X ESSENTIAL 115VAC
1R38	DEV1 & 2 1ST PLT SW SUP	1-213	3P ESSENTIAL 28VDC
1R25	ILS VHF NAV1 SUP	2-213	6X ESSENTIAL 115VAC
2R38	DEV1 & 2ND PLT SW SUP	15-216	2P NORMAL 28VDC
2R33	VOR VHF NAV2 SUP	13-216	11X SHEDDABLE 115VAC
2R25	ILS VHF NAV2 SUP	13-216	11X SHEDDABLE 115VAC
1S32	No.1 WEATHER RADAR IND	13-215	10X SHEDDABLE 115VAC
1S30	WEATHER RADAR SUP	13-215	10X SHEDDABLE 115VAC
2S32	No.2 WEATHER RADAR IND	13-216	3X NORMAL 115VAC
2S30	WEATHER RADAR SUP	13-216	3X NORMAL 115VAC
1S56	RAD ALT1 SUP	2-213	33X STBY AC 115VAC
S57	RAD ALT1 & 2 IND	15-215	1P NORMAL 28VDC
2S56	RAD ALT2 SUP	13-216	11X SHEDDABLE 115VAC
1F14	INS1 HTR SUP	2-213	6X ESSENTIAL 115VAC
1F20	INS1 SUP	2-213	6X ESSENTIAL 115VAC
1F15	ADI 1ST PLT INS1 SUP & IND	2-213	14XS ESSENTIAL 26VAC
1F21	HSI TRUE 1ST PLT INS1	2-213	14XS ESSENTIAL 26VAC
1F16	HSI MAG 1ST PLT INS1 SUP	2-213	14XS ESSENTIAL 26VAC
1F13	ATT INS 1ST PLT SW SUP	1-213	3P ESSENTIAL 28VDC
1F34	NAV INS 1ST PLT SW SUP	1-213	3P ESSENTIAL 28VDC
1F26	RAD INS 1ST PLT SW SUP	1-213	3P ESSENTIAL 28VDC
2F14	INS2 HTR SUP	13-216	11X SHEDDABLE 115VAC
2F20	INS2 SUP	13-216	3X NORMAL 115VAC
2F15	ADI 2ND PLT INS2 SUP & IND	13-216	13XS NORMAL 26VAC
2F21	HSI TRUE 2ND PLT INS2 SUP & IND	13-216	13XS NORMAL 26VAC
2F16	HSI MAG 2ND PLT INS2 SUP & IND	13-216	13XS NORMAL 26VAC
2F13	ATT INS 1ST SW SUP	15-216	2P NORMAL 28VDC
2F34	NAV INS 1ST PLT SW SUP	15-216	2P NORMAL 28VDC
2F26	RAD INS 1ST PLT SW SUP	15-216	2P NORMAL 28VDC
3F14	INS3 HTR SUP	13-215	10X SHEDDABLE 115VAC
3F20	INS3 SUP	13-215	2X NORMAL 115VAC
3F15	ADI PLT INS3 SUP & IND	2-213	14XS ESSENTIAL 26VAC
3F30	INS3 26VAC SUP	2-213	14XS ESSENTIAL 26VAC
F3	INS COMPTR SUP2	2-213	14X ESSENTIAL 26VAC
F5	INS COMPTR SUP & IND	1-213	3P ESSENTIAL 28VDC
F4	INS COMPTR SUP1	2-213	6X ESSENTIAL 115VAC
F2	INS COMPTR SUP3	13-216	13X NORMAL 26VAC
1S4	DME 1 SUP	2-213	6X ESSENTIAL 115VAC

CIRCUIT BREAKER	SERVICE	PANEL	BUSBAR
1S3	DME 1 IND	2-213	14X ESSENTIAL 26VAC
2S4	DME 2 SUP	13-216	11X SHEDDABLE 115VAC
2S3	DME 2 IND	13-216	13X NORMAL 26VAC
S13	ATC 1 SUP	2-213	6X ESSENTIAL 115VAC
S14	ATC 2 SUP	13-216	3X NORMAL 115VAC
1R173	ADF 1 SUP	1-213	3P ESSENTIAL 28VDC
1R174	ADF 1 IND	2-213	14XS ESSENTIAL 26VAC
2R173	ADF 2 SUP	15-216	2P NORMAL 28VDC
2R174	ADF 2 IND	13-216	13XS NORMAL 26VAC
W631	GRND PROXIMITY WARN A/C SUP	13-215	2X MAIN 115VAC
W632	GRND PROXIMITY WARN D/C SUP	15-215	1P MAIN 28VDC
1F222	CARD READER 1SUP	15-215	1P MAIN 28VDC
2F222	CARD READER 2SUP	15-216	2P MAIN 28VDC
** ON A/C 001-005,			
3F73	CABIN MACHMETERS 115VAC SUP	13-216	11X AVIONICS 115VAC
3F74	CABIN MACHMETERS 28VDC SUP	15-216	2P MAIN 28VDC
** ON A/C 006-007,			
F118	CABIN MACHMETERS 115VAC SUP	13-216	11X AVIONICS 115VAC
F117	CABIN MACHMETERS 28VDC SUP	15-216	2P MAIN 28VDC
R			
S13	ATC1 MODE S	2-213	6X ESSENTIAL 115VAC
S86	TCAS	13-215	2X No.2 MAIN 115VAC
S95	VSI TCAS PILOT	13-215	2X No.2 MAIN 115VAC
S14	ATC2 MODE S	13-216	3X No.3 MAIN 115VAC
S96	VSI TCAS CO-PILOT	13-216	3X No.3 MAIN 115VAC

GENERAL - SERVICING

RB WARNING: WHEN PITOT PROBES/STATIC PORTS ARE COVERED ENSURE THAT
RB THIS CONDITION IS VISIBLE FROM THE GROUND. IN ADDITION,
RB ATTACH A LABEL (PART NO. 20005 ANNOTATED AS APPLICABLE
RB WITH PITOT PROBES COVERED AND/OR STATIC PORTS COVERED)
RB TO THE LEFT CONTROL WHEEL AS A REMINDER THAT THE PITOT
RB PROBES/STATIC PORTS ARE COVERED. FAILURE TO REMOVE
RB THESE COVERINGS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN
RB AIRSPEED AND ALTITUDE SENSOR OUTPUTS WHICH MAY LEAD TO
RB LOSS OF SAFE FLIGHT.

RB NOTE: Whenever Pitot or Static ports are covered there must be a
RB clear unambiguous entry in the Technical Log saying that
RB the aircraft's Pitot and/or Static ports are covered, and
RB the aircraft is no longer airworthy as a result of the
RB installation.

RB Reliance on warning or attention getting flags attached to
RB blanks or covers is not by itself sufficient to ensure the
RB covers are identified and removed before flight,
RB particularly in darkness or adverse weather conditions.

1. Safety Precautions

WARNING: BEFORE PROCEEDING WITH MAINTENANCE WORK ON OR NEAR MECHANICAL FLIGHT CONTROLS OR PRIMARY FLIGHT CONTROL SURFACES, LANDING GEARS, ASSOCIATED DOORS OR ANY MOVING COMPONENT, MAKE CERTAIN THAT GROUND SAFETIES AND/OR WARNING NOTICES ARE IN CORRECT POSITION TO PREVENT INADVERTENT OPERATION OF CONTROLS.

BEFORE POWER IS SUPPLIED TO THE AIRCRAFT MAKE CERTAIN THAT ELECTRICAL CIRCUITS UPON WHICH WORK IS IN PROGRESS ARE ISOLATED.

WHEN EQUIPMENT IN RACKS AND/OR FLIGHT COMPARTMENT INSTRUMENTS ARE SUPPLIED WITH POWER FROM THE GROUND POWER UNIT, THE ELECTRONICS COMPARTMENT COOLING SYSTEM AND APPROPRIATE VENTILATION SYSTEMS MUST BE IN OPERATION.
THE GROUND DEPRESSURIZATION VALVE MUST BE OPEN.
FURTHERMORE, IF AMBIENT TEMPERATURE IS ABOVE 30°C IN THE FLIGHT COMPARTMENT, THE GROUND AIR PRECONDITIONING SYSTEM MUST BE IN OPERATION.

OPERATION OF RADAR IS FORBIDDEN DURING REFUELLING OF THE AIRCRAFT.

2. Technical Precautions

A. Flight environment data

(1) Make certain that when work is in progress near the various sensors (nose probe, angle of attack sensor ...) that protective covers are fitted.

(2) During ground tests requiring use of a pressure generator or pressure pickoff electrical simulator, in order to avoid damage to temperature indicators:

(a) Limit mach value to M = 1.6.

(b) If mach value must be increased above 1.6, disconnect total temperature probes and replace them by a decade box (Ref. 34-11-00, Adjustment/Test, paragraph 2) and select a value of 593.56 ohms, corresponding to Tt = - 50°C.

(c) If a flight environment data or peripherical circuit test is to be carried out at a value of M = 2, do not use pressure generator or pressure pick off electrical simulator but carry out TEST 2 from control panel or front panel of ADC.

B. Flux valve

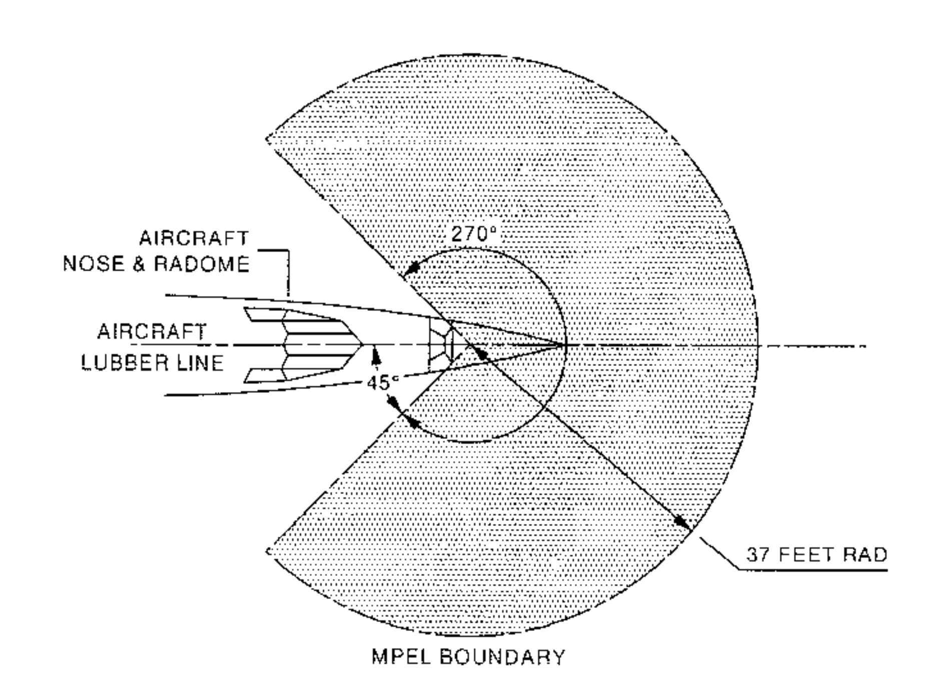
As the flux valve is extremely sensitive to magnetic fields, an operation within 0.50 m (20 in) of the flux valves must be carried out using non magnetic tools and parts (Ref. 34-21-17 and 34-53-14, Removal/Installation).

C. Weather Radar (Ref. Fig. 301)

(1) Radiation emitted by aircraft weather radar

WARNING: RADIATION FROM THE WEATHER RADAR CAN CAUSE BURNS AND SECONDARY EFFECTS OF RADIATION TO THE EYES AND SENSITIVE ORGANS OF THE BODY.

Personnel must remain at a minimum distance of 11.10 m (37 ft) from the antenna in order to be outside the range of Maximum Permissible Exposure Level (MPEL) of 10 mW/cm2 fixed by the US Air Force microwave exposure standards.
The distance of 37 ft or the radius determined by the MPEL are calculated on the basis of reflector diameter and peak power of the weather radar system.
The minimum safe distance is calculated for the scan sector or for antenna position when antenna is not scanning.



Weather Radar - Maximum Permissible Exposure Level
Figure 301

(2) Special conditions during transmission

During a transmission test, make certain that:

- Nose of the aircraft is not pointed towards hangars, other aircraft or any other metallic mass
- The 180° sector forward of the aircraft is clear of obstacles
- On radar control unit, tilt control is in UP position at an angle selected by the operator.

D. Radio-altimeter

During removal of transceivers from their rack, check at rear of rack that coaxial connectors integral with DPX2 connectors are not unlocked (Ref. NOTE 2, 34-42-00, Trouble Shooting).

E. Inertial navigation system

(1) If during operation or tests, FLOW warning lights illuminate because of a ventilation system fault, shut down INS systems immediately.

(2) During ALIGN mode, aircraft must not be moved, but loading, passenger boarding and replenishment are permissible.

(3) If ATT REF function is inadvertently selected, it causes loss of system alignment of INS in operation. Note that alignment operations can only be performed on the ground.

(4) During INS1 or INS2 self-test or in NAV mode operation, make certain that no automatic pilot mode is engaged.

(5) In case of a cut in 115 VAC power from the electrical ground power unit when an INS system is in operation, do not operate the system for more than 5 minutes on battery.

(6) Wait 4 minutes between shut-down and start-up of an INS system.

F. VOR/LOC antennae

During check of VOR/LOC antennae for excessive wear of coaxial connector centre pins on the hybrid couplers, make certain that on the aircraft coaxial cable side connectors, the body screwed to the crimped section is locked (Ref. 34-55-00, Inspection/Check).

1. General

R The following text provides general removal/installation procedures for rack-mounted equipment installed in electronics rack shelves located in the various aircraft compartments, control units and indicators in the flight compartment.
This removal/installation procedure concerns only the equipment described in the chapter.

R NOTE 1 : Equipment, connectors, cables and wires must be checked for evidence of damage.

Equipment and rack connectors must be checked for :

R - correct condition of pins (no trace of oxidation)
R - correct external condition of connectors.

R NOTE 2 : Indicators are visually checked for correct external condition.

R NOTE 3 : For air-cooled equipment installed on panels, shelves or racks, it is necessary to blank off ventilation outlets when removing the equipment unless replacement is performed immediately.
Non-observance of this precaution can result in ventilation failure leading to damage to other equipment on panel or shelf.

2. Rack-Mounted Equipment

R NOTE 1 : As all rack-mounted equipment dealt with in this chapter is identically installed, only one removal/installation procedure is described.

R NOTE 2 : Certain units (such as radar transceiver and antenna, ADC, inertial navigation unit) require precautions to be taken because of their weight.

NOTE 3 : On equipment with front panel connectors, disconnect the connectors before removal and reconnect after installation of unit.

A. Reasons for the Job

R (1) Removal for replacement of a faulty component.

R (2) Removal for maintenance operation on the component, on the associated circuitry or to gain access to

R another item of equipment.

B. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps for Connectors (Electrical and Pneumatic)	
R Blanking Caps for ADS Pressure Lines	
R Blanking Plates for Ventilation Outlets	
R Air Data Computer	34-11-41, R/I
R Flux Valve Compensator	34-21-18, R/I
R Compass Coupler Switching Unit	34-21-31, R/I
R Compass Coupler Units	34-21-35, R/I
R Static Inverter	34-22-12, R/I
R VOR-ILS & RAD-INS Switching Unit	34-23-13, R/I
R Track Heading Unit	34-23-61, R/I
R Marker Beacon Receiver	34-33-12, R/I
R ILS Receiver	34-36-31, R/I
R Wave Guide Switch	34-41-18, R/I
R Switching Logic Assembly	34-41-19, R/I
R Weather Radar Transceiver	34-41-33, R/I
R R/A Transceiver	34-42-41, R/I
R Inertial Navigation Unit	34-45-34, R/I
R ATT/INS & NAV/INS Switching Unit	34-45-35, R/I
R Battery Unit (INS)	34-45-38, R/I
R GPWS Computer	34-47-12, R/I
R DME Interrogators	34-51-33, R/I

DESCRIPTION	PART NO.
ATC Transponders	34-52-33, R/I
ADF Receivers	34-53-12, R/I
VOR Receivers	34-55-31, R/I
R TCAS Transponder	34-43-13, R/I

NOTE: Refer to 34-XX-XX, Removal/Installation, for:

- location of component(s) to be removed
- prepare and preparation of replacement component procedures
- removal/installation procedure
- functional test procedure

C. Prepare

(1) Refer to 34-XX-XX Removal/Installation

D. Remove

NOTE: Grip handles are not identical on all components but their use is similar.

The equipment can be secured in the rack in various ways:

- by retaining nuts
- by locking handles
- by attaching screws

(1) Removal of units secured by retaining nuts (Ref. Fig. 401)

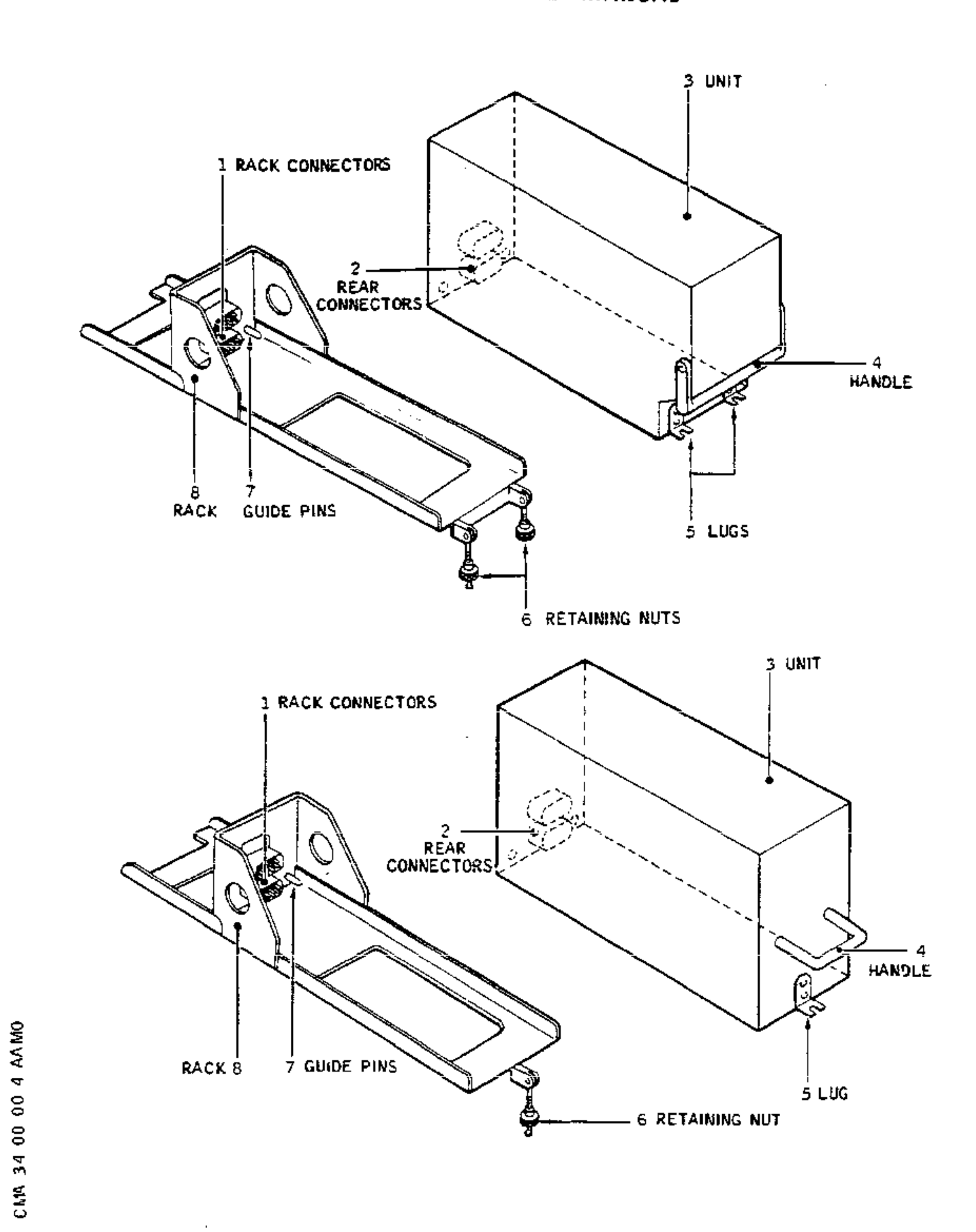
(a) Loosen retaining nuts (6) until lugs (5) are free.

(b) Swing downwards retaining nut shafts.

(c) Slowly pull handles (4) to disconnect rear connectors (2) on unit (3) from rack (8) and rack connectors (1). Continue to pull until equipment is fully disengaged from rack slides.

(d) Cap connectors (1) and (2).

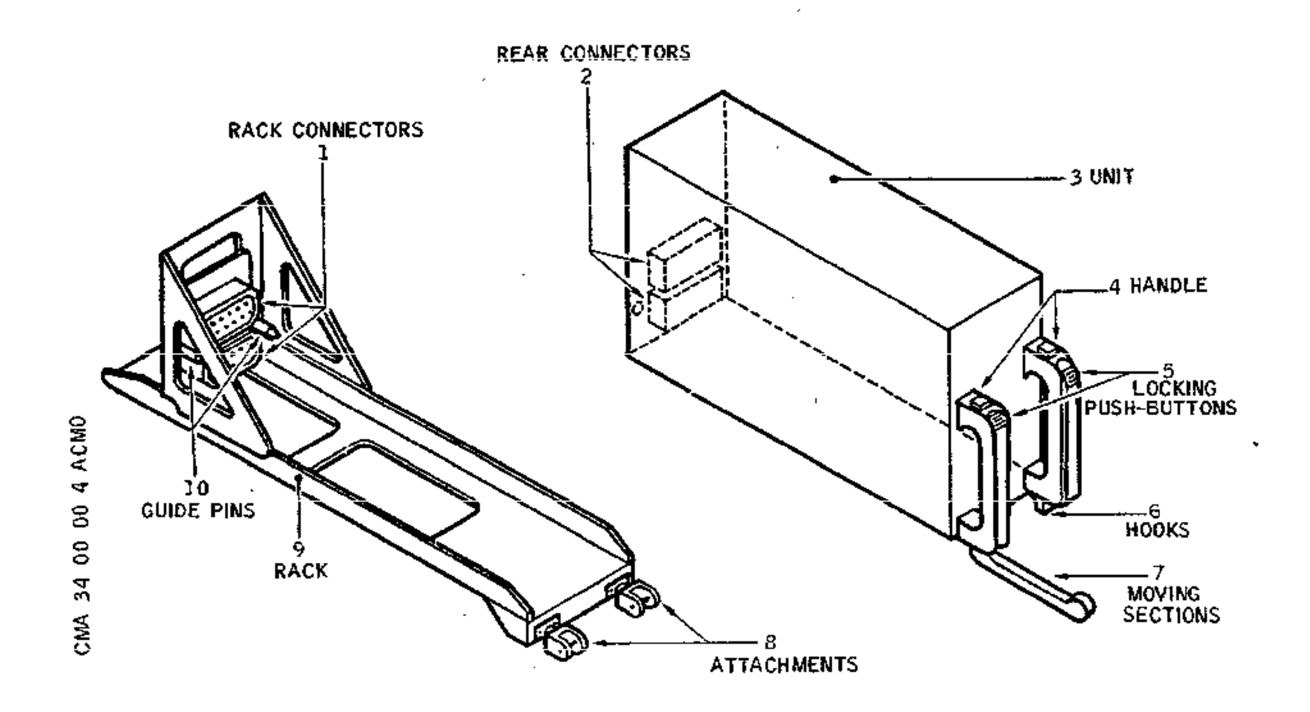
(e) Install blanking plate(s) on ventilation outlet(s).



Rack-Mounted Equipment : Removal/Installation
Figure 401

left open on shelf.

(2) Removal of units secured by locking handles (Ref. Fig. 402).



Rack-Mounted Equipment : Removal/Installation
Figure 402

R (a) Press locking push-buttons (5) on handles (4)
R to free moving sections (7) of handles (4).

(b) Slowly lower both moving sections (7) together
R until horizontal to disengage hooks (6) from their attachments (8) on rack (9).

The moving sections (7) act as a lever on attachments (8) and free rear connectors (2) on unit (3), rack (9) connectors (1) and guide pins (10).

(c) Raise and lock moving sections (7) of handles (4).

R (d) Pull out by means of handles (4) until unit is completely disengaged from rack slides.

R (e) Cap connectors (1) and (2).

R (f) Install blanking plate(s) on ventilation outlet(s) left open on shelf.

E. Preparation of Replacement Component

R (1) Make certain that rack is clean and connectors in
R correct condition (Ref. Para. 1. NOTE 1).

R (2) Visually check that :

R - Replacement component is in correct condition
R - Connector(s) is (are) undamaged and show no trace
R of oxidation.

F. Install

(1) Installation of units secured by retaining nuts. (Ref. Fig. 401)

R (a) Remove blanking caps from connectors (1) and (2),
R and blanking plate(s) from ventilation outlet(s) on shelf.

R (b) Position unit (3) on rack (8) and slowly slide
R rearwards, making certain that guide pins (7)
R properly engage in holes on unit.

R (c) Continue to push unit taking care to slowly engage
R connectors (1) and (2).
R When unit is at stop, unit and rack front panels
R must be flush.

R (d) Lift retaining nut (6) shafts, engaging nuts on
R lugs (5), tighten nuts until locked.

(2) Installation of units secured by locking handles. (Ref. Fig. 402)

(a) Remove blanking caps from connectors (1) and (2),
R and blanking plate(s) from ventilation outlet(s) left open on shelf.

(b) Position unit (3) on rack (9).

R (c) Press locking push-buttons (5) on handles (4)
R to lower moving sections (7) of handles.

R (d) Push unit (3) on rack (9) slides until hooks (6) at bottom of moving sections (7) of handles coin-

cide with attachments (8) on rack (9).

(e) Raise moving sections (7) of handles and lock. Moving sections (7) act as levers on attachments
R (8) and engage connectors (1) and (2) and guide pins (10).

R G. Test

R (1) Refer to 34-XX-XX, Removal/Installation.

R H. Close-Up

(1) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

3. Control Units

R NOTE : As all control units (control box, display units, selec-
R tor units) dealt with in this chapter are identically
R installed, only one removal/installation procedure is described.

A. Reasons for the Job

R (1) Removal for replacement of a faulty control unit.

R (2) Removal for maintenance operation on the control unit,
R on the associated circuitry or to gain access to
R another item of equipment.

B. Equipment and Materials

	DESCRIPTION	PART NO.
	Circuit Breaker Safety Clips	
	Blanking Plugs/Caps for Connectors	
	Blanking Plates for Ventilation Outlets (if required)	
R	ADC Control Panel	34-11-29, R/I
R	MHRS Controller	34-21-12, R/I
R	Weather Radar Control Panel	34-41-12, R/I
R	INS Mode Selector Units	34-45-12, R/I

DESCRIPTION	PART NO.
INS Control Display Units	34-45-13, R/I
R	
ADF Controller	34-53-32, R/I
VOR/ILS/DME Control Units	34-55-13, R/I
R	
ATC/TCAS Control Panel	34-43-12, R/I

NOTE: Refer to 34-XX-XX, Removal/Installation for:

- location of component(s) to be removed
- prepare and preparation of replacement component procedures
- removal/installation procedure
- functional test procedure

C. Prepare

(1) Refer to 34-XX-XX, Removal/Installation.

D. Remove (Ref. Fig. 403)

(1) Unlock the four dzus fasteners (3) from seating (1).

(2) Pull control unit (2).

(3) Disconnect electrical connector(s) (5) from control unit connector(s) (4).

(4) Remove control unit (2) and cap connectors (4) and (5).

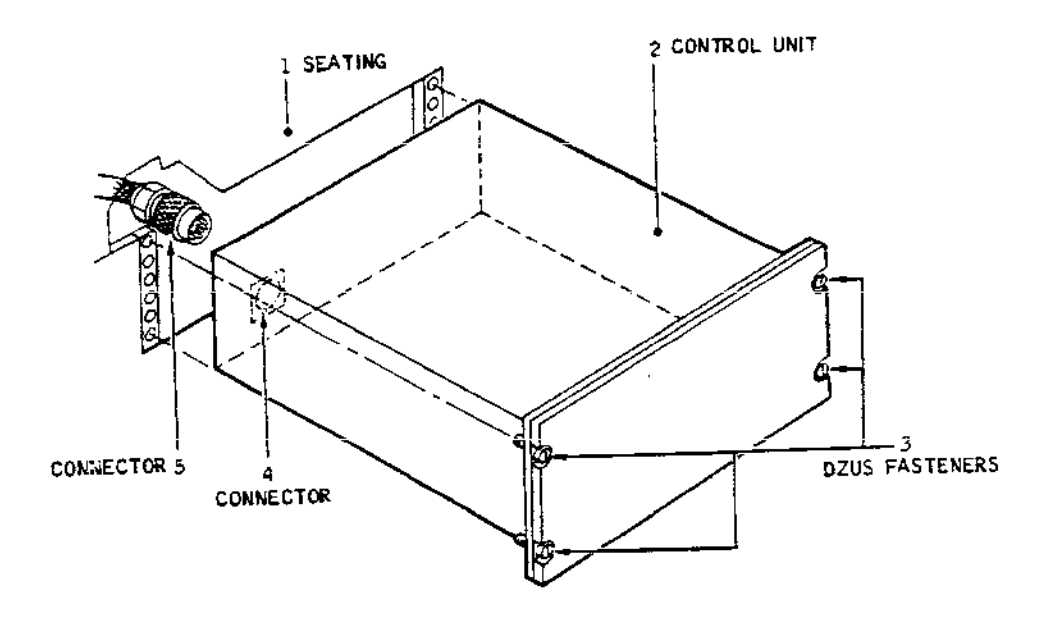
(5) Install blanking plate(s) on ventilation outlet(s) left open on shelf or panel.

E. Preparation of Replacement Component

(1) Make certain that control unit seating is clean and that connector(s) is (are) in correct condition (Ref. Para.1. NOTE 1).

(2) Visually check that:

- replacement component is in correct condition
- connector(s) is (are) undamaged and show no trace of oxidation.



Control Unit - Removal/Installation
Figure 403

F. Install
(Ref. Fig. 403)

(1) Remove blanking caps from connectors (5) and (4), and
R blanking plate(s) from ventilation outlet(s) on shelf or panel.

R (2) Position control unit (2) in front of its seating (1).

(3) Connect connector (5) to connector (4) on control unit.

R (4) Position control unit (2) in seating (1) to align the
R dzus fasteners with the relevant holes.

(5) Lock the four dzus fasteners (3).

R G. Test

R (1) Refer to 34-XX-XX, Removal/Installation.

H. Close-Up

(1) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

4. Indicators

NOTE: The indicators installed on Captain's and First Officer's instrument panel or Flight Engineer's panel are secured as follows:

- Independent mounting: the indicators have holes in the corners of the front panel to take attaching screws.
- Mounting by adapter plate: the indicator front panel has no holes but is secured by an adapter plate which is attached by screws.

A. Reasons for the job

(1) Removal for replacement of a faulty indicator.

(2) Removal for maintenance operation on the indicator, on the associated circuitry or to gain access to another item of equipment.

B. Equipment and Material

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	-
Blanking Plugs/Caps for Electrical Connectors	-
Blanking Caps for ADS Pressure Lines	-
Blanking Plates for Ventilation Outlets (if required)	-
R VSI TCAS	34-11-10, R/I
Temperature Indicators	34-11-11, R/I
Angle of Attack and Acceleration Indicators	34-11-12, R/I
Altimeters	34-11-13, R/I
Machmeters	34-11-14, R/I
Airspeed Indicators	34-11-15, R/I
Vertical Speed Indicators	34-11-16, R/I

DESCRIPTION	PART NO.
True Airspeed Indicator	34-11-21, R/I
Total Temperature Digital Indicator	34-11-22, R/I
Digital Machmeter	34-11-23, R/I
Digital Altimeter	34-11-24, R/I
Cabin Machmeter	34-11-27, R/I
Sideslip Indicator	34-12-21, R/I
R Airspeed/Mach Indicator	34-13-22, R/I
Airspeed Indicators	34-13-23, R/I
Altimeters	34-13-24, R/I
Standby Horizon	34-22-11, R/I
Horizontal Situation Indicators (HSI)	34-23-11, R/I
Attitude Director Indicators (ADI)	34-23-12, R/I
Standby Compass	34-25-21, R/I
Marker Beacon Indicator Light Assembly	34-33-21, R/I
Weather Radar Indicators	34-41-21, R/I
Weather Radar Alert Indicators	34-41-22, R/I
Radio Altimeter Indicators	34-42-31, R/I
R R/NAV Annunciators	34-45-18, R/I
DME Indicators	34-51-23, R/I
RMI-ADF Indicators	34-53-21, R/I
RMI-VOR Indicators	34-55-22, R/I

NOTE : Refer to 34-XX-XX, Removal/Installation for :

- location of component(s) to be removed

- prepare and preparation of replacement component procedures
- removal/installation procedure
- functional test procedure

C. Remove/Install (Ref. Fig. 404)

NOTE : Indicators mounted on the Captain and First Officer instrument panels do not have cables of sufficient length to allow removal directly from front of the instrument panels, it is therefore necessary first to remove the other instruments or sub panels in order to gain access to connectors of indicators to be removed. The recommended removal procedures for instruments are detailed on BA pages.

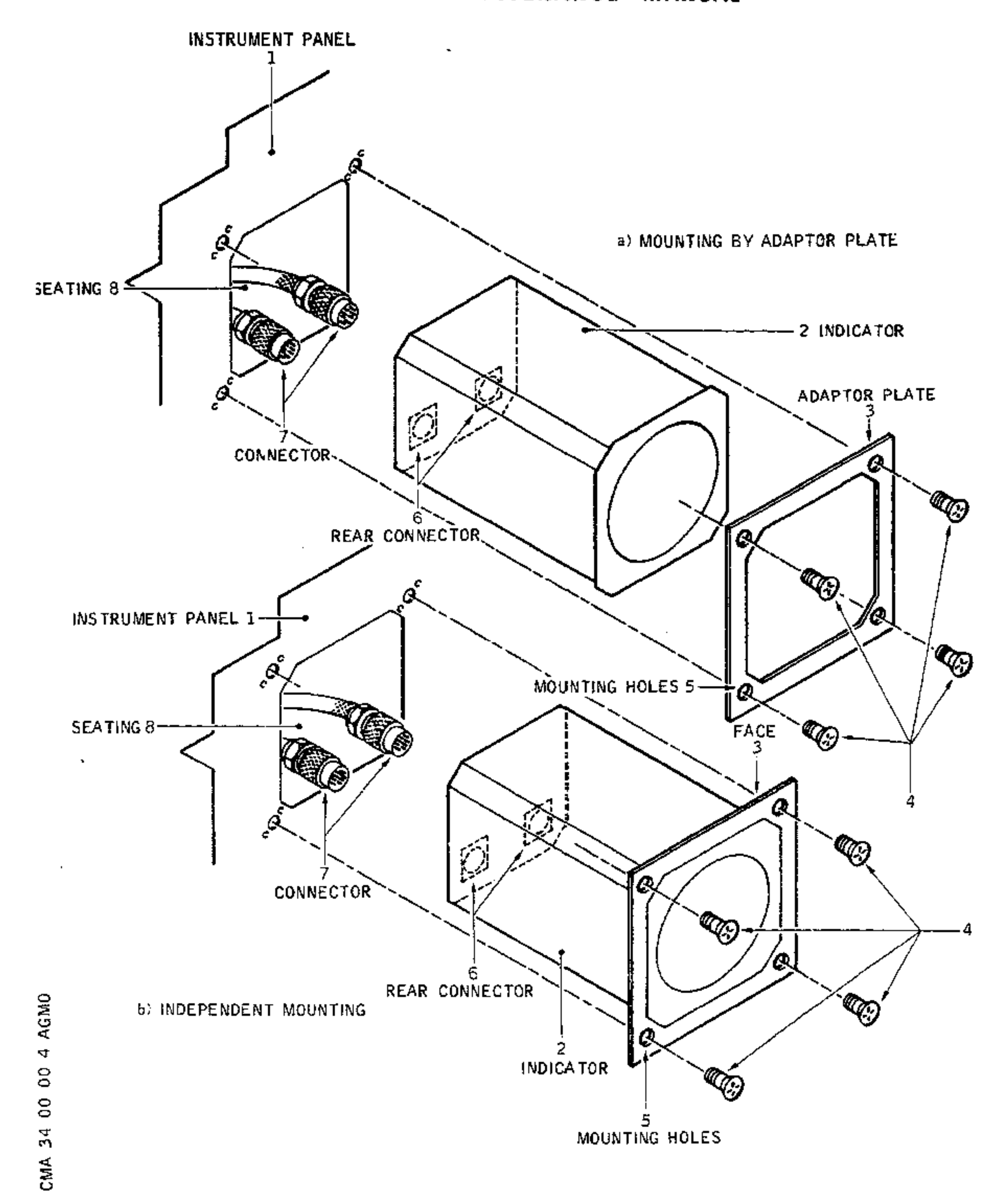
PANEL 2-212

Indicator	Cable Slackness		Method of Removal
Brakes Test	None	)	
D.M.E.	None	)	
D.M.E.	None	)	
R.M.I. (VOR)	None	)	All connectors accessible under duct at lower edge of panel. Disconnect to extract.
R.M.I. (ADF)	None	)	
Side Slip	None	)	
Side Slip	None	)	
Clock	None		Extract sub unit 4 without disconnecting, disconnect clock through sub unit 4 cutout.
Temp	None		Connectors accessible under duct at lower edge of panel. Disconnect to extract.
Mach	Full		Extract to disconnect.
H.S.I.	None		Disconnect from under panel to extract.
H.S.I.	None		Disconnect from under panel to extract.

Indicator	Cable Slackness	Method of Removal
H.D.I.	Half	Extract Mach 2F80 on slack cable without disconnecting, partically extract H.D.I. & H.S.I. on available slack cable and disconnect through mach cutout.
H.D.I.	Half	As above.
L.S.D.	None	Partially lift R.H. glare shield (quick release fasteners) and disconnect L.S.D. before extracting.
L.S.D.	None	As above.
V.S.I.	None	As for L.S.D., but may be necessary to partially extract H.D.I. Alternatively extract sub unit 4 without disconnecting. Partially extract Rad. Alt. on slack cable. Disconnect V.S.I. through sub unit 4 cutout.
V.S.I.	None	As above
Reversionary A.S.I.	None	Disconnect quick release or screwed connectors on "Pitot" & "Static" fixed ends from below panel. Extract mach (but not disconnect) by working through mach cutout. Disconnect plug on A.S.I. to fully extract. For re-installation it may be advantageous to fully extract mach, (but not disconnect).
ICOVOL	None	Connectors accessible under panel. Disconnect to extract.
Angle of Attack & G.	None	Partially extract ICOVOL C82 & DME 257. Disconnect & extract.

Indicator	Cable Slackness	Method of Removal
Undercarriage position	Full	Extract to disconnect.
Nose/Visor control	None	Extract sub-unit 6 without disconnecting, disconnect nose/visor control through sub-unit 6 cutout.
Nose/Visor control	None	As above
Rad Alt	None	Partially lift R.H. glare shield (quick release fasteners). Extract sub-unit 3. Disconnect before extracting.
Reversionary Alt.	None	Disconnect quick release or screwed connector on "static" fixed end from below panel. By working from below panel disconnect plug to fully extract. For re-installation it may be advantageous to fully extract sub-unit 4 (but not disconnect).
Sub unit 1	Full)	Extract to remove
Sub unit 2	Full)	
Sub unit 3	Full)	Remove glareshield. Disconnect & extract.
Sub unit 4	Full)	
Sub unit 6 2047	Full)	
Sub unit 6 2048	Full))	Extract to remove
Sub unit 8	Full)	

PANEL 2-211



R Indicators : Removal/Installation B
Figure 404

Indicator	Cable Slackness	Method of Removal
D.M.E.	None	)
D.M.E.	None	)
R.M.I. (VOR)	None	)
R.M.I. (ADF)		) All connectors accessible under edge of panel. Disconnect to extract.
Sideslip	None	)
Sideslip	None	)
Cabin Alt	None	)
Temp	None	)
Angle of Attack & 'G' Ind.	None	Remove adjacent blank plate to disconnect before extracting
C.G. Ind	Full	Extract to disconnect.
Mach	Full	Extract to disconnect.
H.S.I.	None	Disconnect from under panel to extract.
H.S.I.	None	As above
H.D.I.	Half	Extract Mach 1F80 on slack cable without disconnecting, partially extract H.D.I. & H.S.I. IF22 on available slack and disconnect through mach cutout.
H.D.I.	Half	As above.
L.S.D.	None	Partially lift L.H. glare shield (quick release fasteners and disconnect L.S.D. before extracting.
L.S.D.	None	As above.
V.S.I.	None	) Lift glareshield. Partially extract sub panel 4. Disconnect & extract.
V.S.I.	None	)

Indicator	Cable Slackness	Method of Removal
Reversionary A.S.I.	Half	Life glareshield, disconnect quick release or screwed connectors "pitot" & "static" fixed ends. Extract (but not disconnect) mack & partially extract A.S.I. working through mach cut-out. Disconnect plug on A.S.I. to fully extract. For reinstallation it may be advantegeous to partially extract H.D.I.
Clock	None	Connector can be reached under panel. Disconnect to extract.
Clock	None	As above.
S/B Horizon	Full	Lift glareshield. Partially extract sub panel 4, V.S.I. & Rad. Alt. Disconnect to extract.
Rad Alt	None	Lift glareshield. Partially extract sub panel 4. Disconnect & extract.
Reversionary Alt.	None	Disconnect quick release or screwed connector on "static" fixed end from below panel. Disconnect plug from below panel & extract.
Sub unit 2	Full	)
Sub unit 3	Full	)
Sub unit 4	Full	) Extract to disconnect.
Sub unit 5	Full	)
I.N.S. Annunciator	Full	)
Sub unit 8	Full	)

INDICATOR	CABLE SLACKNESS	METHOD OF REMOVAL
Ratings Annunciator	Full	Extract to disconnect.
S/B ASI/Mach	Full	Lift glareshield, disconnect quick release or screwed connectors on "pitot" & "static" fixed ends. Extract & disconnect.
VSI/TCAS	Full	Extract to disconnect.

FLIGHT ENVIRONMENT DATA - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

Flight environment data encompasses the following systems :

- A normal air data system which enables airspeed, altitude and temperature parameters to be obtained. These are required for checks in flight and for transmission to peripheral systems.
- A sideslip system which displays angle of sideslip on the indicators
- A standby air data system which enables checks of flight parameters by means of instrument readings in case of fault in part or all of the normal air data system.

2. Normal Air Data System

The normal air data system consists of two ADC computers which receive local parameter information collected outside the aircraft by means of detectors (pitot heads, total temperature and angle of attack sensors and static ports). For calculation of parameters, weight information from the centre of gravity computer and nose position angle signal are required.
Each ADC converts information values received into mach (m) airspeed (Vc), altitude (Hp) output parameters which are sent to peripheral systems and instruments.

3. Sideslip

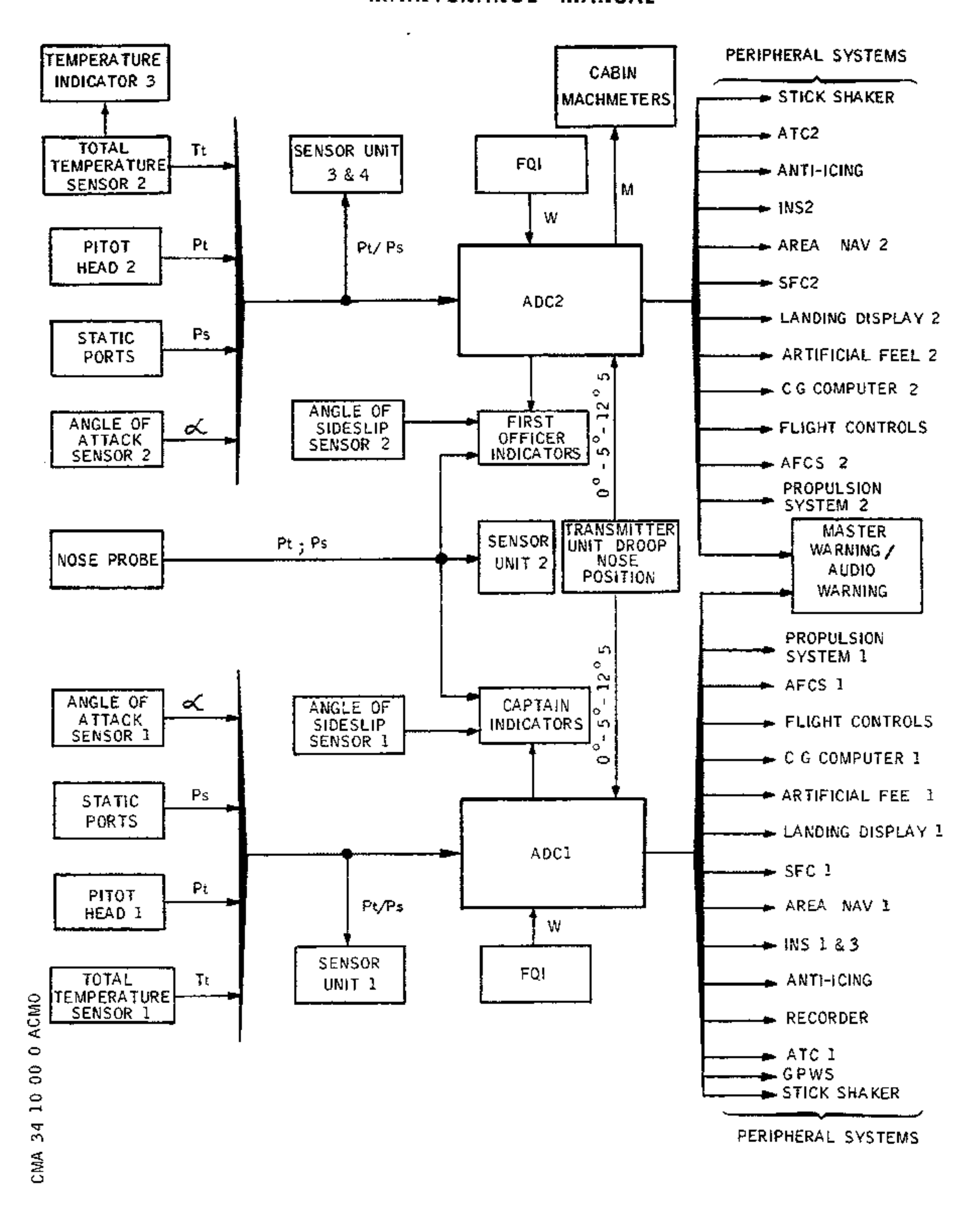
The system consists of two angle of sideslip sensors which are not connected to the ADC. They directly transmit their angle of sideslip signals to sideslip indicators on the instrument panels.

4. Standly Air Data System

The standby air data system enables a check of flight parameters to be made on the following instruments on the instrument panels :

- Airspeed/mach indicator
- Standby altimeter
- Altimeters and airspeed indicators in STBY mode, when there is a fault in the ADC or an instrument fault in NORMAL mode.

The standby system receives its information from the nose probe which supplies static pressure (Ps) and total pressure (Pt) to the appropriate instruments.
The airspeed/mach indicator operates permanently from (Ps)



Flight Environment Data - Block Diagram
Figure 001

R

and (Pt) data from the nose probe, and indicates M, Vc and VMO parameters.
The standby altimeter operates permanently from (Ps) data from the nose probe and indicates Hp and barometric pressure parameters.

FLIGHT ENVIRONMENT DATA - MAINTENANCE PRACTICES

1. General

A. Electrical de-icing.

The pitot/static nose probe, fuselage mounted pitot probes and static vents, are electrically heated for de-icing purposes.

If they are switched on when the aircraft is on the ground they get HOT.
(The pitot probes can generate tip temperatures of up to 500°c under no airflow conditions).
Before any maintenance work is carried out in the immediate vicinity of these probes and vents, it must be checked that the relevant probe sensor heating supply is switched off, and a "DO NOT OPERATE" sign is placed on the relevant heater control switch.
Ground operation of probes and vents, heaters should be kept to a minimum. Heaters should only be operated on the ground, during Maintenance, when checking the function of the current sense relays, and correct operation of the heating circuits.
Pitot/static nose probe, pitot probe and static vent heaters MUST NOT be switched on under any circumstances when leak testing adaptors, protective covers or blanks are fitted.

2. Leak Checks

A. Leak checks must be performed at pre-determined check cycles and when :

(1) Any connection in the STANDBY pitot/static system is disturbed. e.g. Pitot/Static Nose Probe, Altimeter,
R Airspeed Indicator, Combined Speed Indicator,
R and No.2 "Air Intake Sensor Unit".

(2) If more than one pitot and one static quick release connection are disturbed in one main system e.g. No.2 ADC and No.3 or No.4 Air Intake Sensor Unit.

(3) If any quick release connections in both main pitot/static systems are disturbed, both systems must be leak checked e.g. interchange of ADC's or Air Intake Sensor Units.

(4) If any pitot/static connections, other than the quick release type are disturbed in any pitot/static system e.g. Pitot Heads, Static Vents and Drain Taps.

No leak check is required if only one pitot and one static quick release connections on only one system are disturbed e.g. a single ADC change or a single Air Intake Sensor Unit change.

B. Equipment Required :

Static Port Adapter	T8751E22783002
Static Port Adapter	T8751E22783003
Pitot Tube Adapter	853BFT025
Pitot Tube Drain Blank	853BFT026
Pitot/Static Noise Probe Adapter	E21922
Bryans leak tester	Model No.1938 (65-500 kts) or equivalent.

C. Leak Checks

(1) All leak checks, unless otherwise stated and with the exception of pre-determined check cycle leak checks, are to be carried out at pressures equivalent to 350 kts, with pressure applied to the pitot system, and vacuum to the static system, as appropriate.

(2) Leakage limit is a maximum of 3 kts. over a 3 minute period.

(3) With 350 kts. pitot pressure applied the equivalent pressures and instrument readings are 6.28 ins. Hg, 212.8 mb, ASI 350 kts.

(4) With 350 kts. static pressure applied the equivalent pressures and instrument readings are 6.28 ins. Hg, 212.8 mb, ASI 350 kts. MACH 0.59, ALTIMETER 6,380 feet.

FLIGHT ENVIRONMENT DATA - INSPECTION/CHECK

1. General

The purpose of this inspection/check is to drain off water from the lines connecting the total and static pressure sensors to the ADC and instruments.

2. Normal Air Data System

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform, Height of Access 3.67 m (12 ft.)	

B. Prepare (Ref. Fig. 601)

(1) Position access platform in zone 113 and open access door 113AB.

(2) Press end of water drain P02, P03 in order to drain off water from lines.

(3) In same zone open access door 113DB.

(4) Press ends of water drains P02, P03.

(5) Position access platform in zone 121 and open access doors 121FB and 121GB.

(6) Press ends of water drains S16/19, P02, P03, S17/18.

C. Tests

(1) Carry out a leakage test of system, (Ref. 34-11-00, Adjustment/Test).

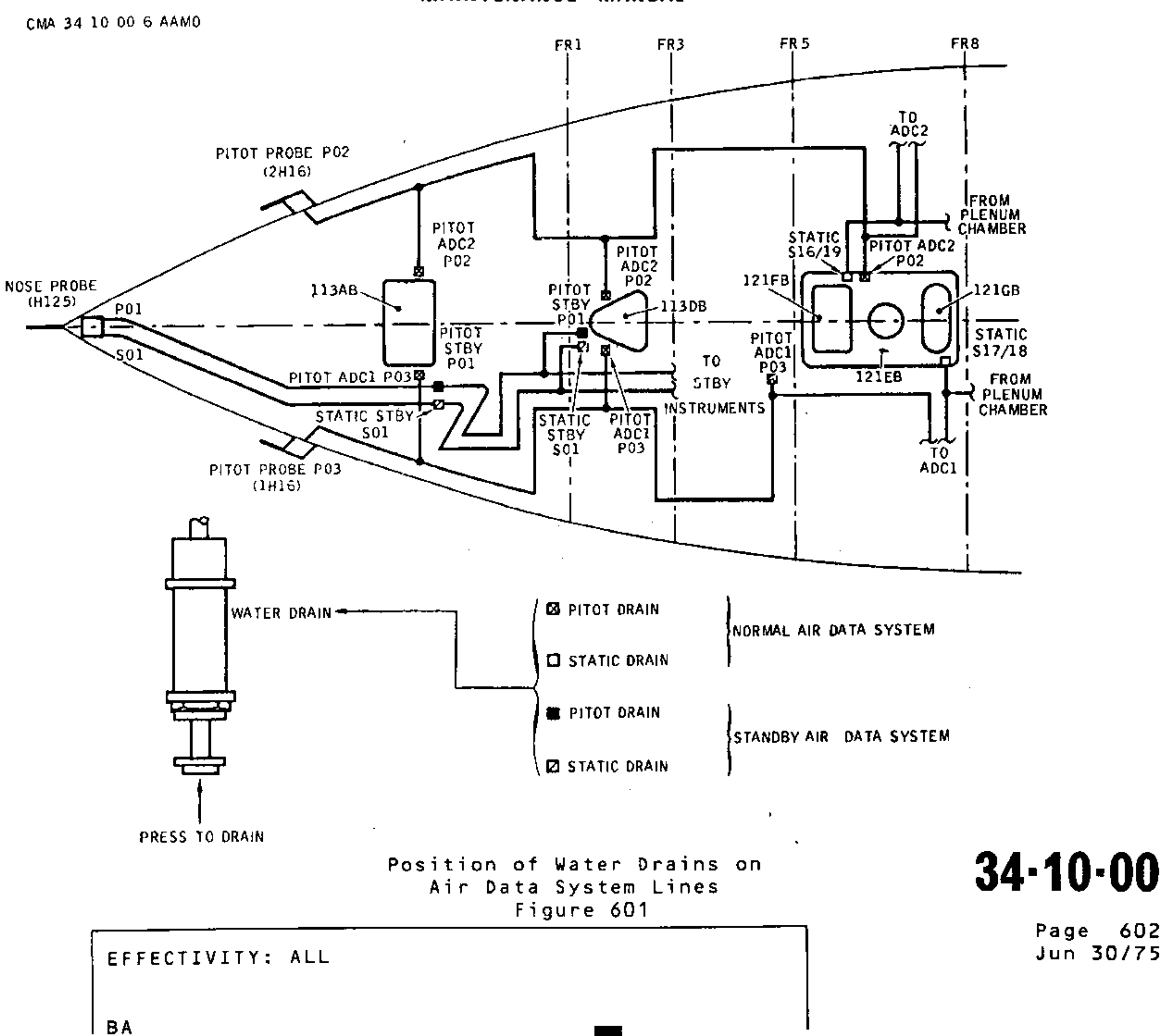
3. Standby Air Data System

A. Equipment and Materials

Refer to paragraph 2A.

B. Prepare

(1) Position access platform in zone 113 and open access



Position of Water Drains on
Air Data System Lines
Figure 601

door 113AB.

(2) Press ends of water drains P01, S01 in order to drain off water from lines.

(3) In same zone open access door 113DB.

(4) Press ends of water drains P01, S01.

C. Tests

(1) Carry out a leakage test of system, (Ref. 34-13-00, Adjustment/Test).

END OF THIS SECTION

NEXT

NORMAL AIR DATA INSTRUMENTATION - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

The purpose of the normal air data instrumentation system is to supply to the aircraft navigation instruments and to the various aircraft systems, parameters such as altitude, airspeed, angle of attack etc, calculated by the air data computers. The calculations are produced from total and static pressure pneumatic information and from electrical signals produced by sensors. The two computers also receive position signals from the droop nose.
Pneumatic signals Pt and Ps from the sensors are channelled to the appropriate computers and pressure transmitters which form part of the engine air intake control system. The influence of sideslip is eliminated by averaging Ps information from the static pressure ports at each side of the fuselage.

2. Description

A. Air Data System (Ref. Fig. 002)

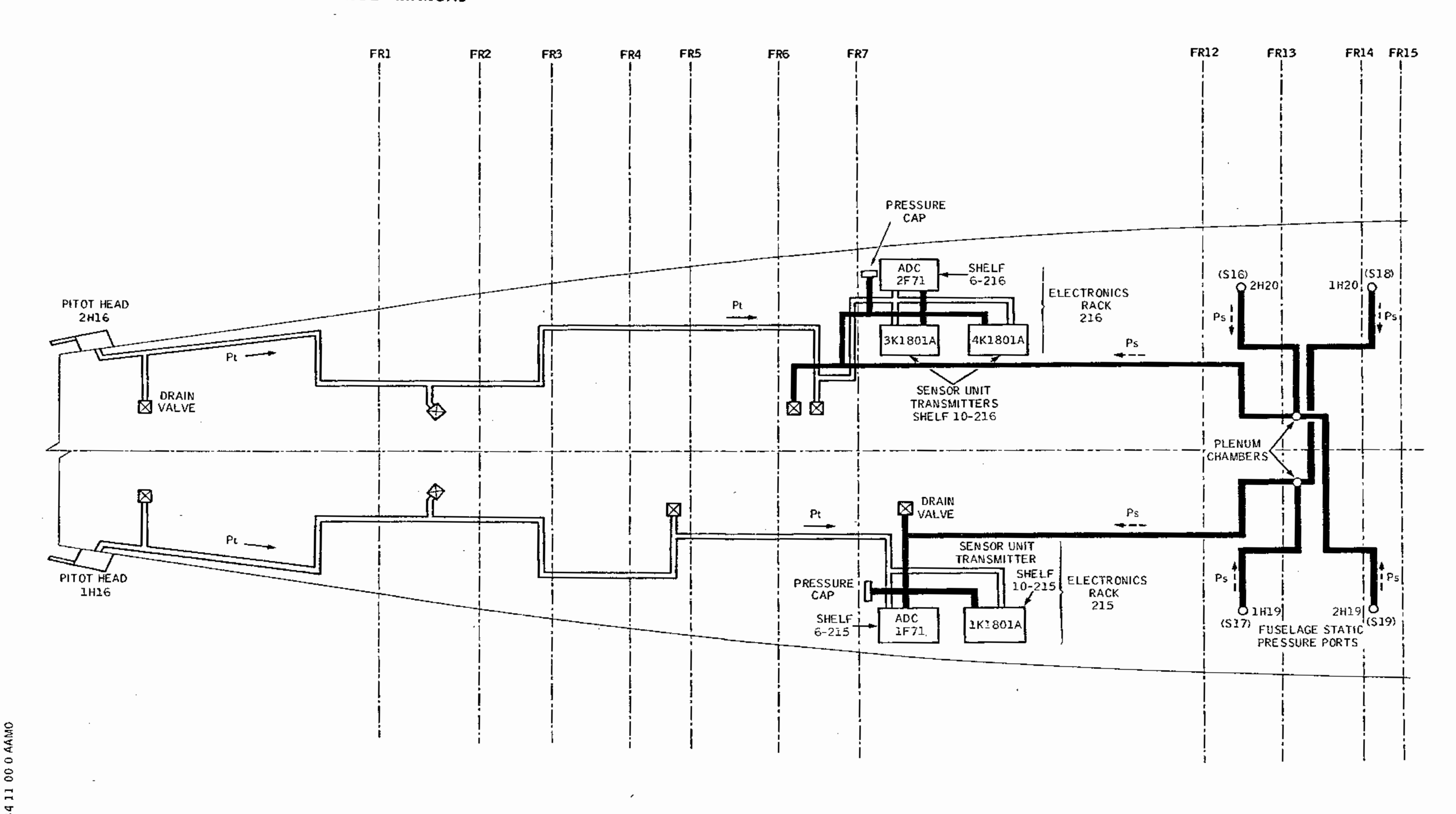
The normal air data system consists of sensors, computers and instruments as follows:

- 2 pitot heads (1H16, 2H16) (Ref. 34-11-30)
- 4 static ports (1H19, 1H20, 2H19, 2H20) (Ref. 34-11-30)
- 2 angle of attack sensors (1F91, 2F91) (Ref. 34-11-30)
- 2 total temperature sensors (1F98, 2F98) (Ref. 34-11-30)
- 2 computers (1F71, 2F71) (Ref. 34-11-40)
- 2 altimeters (1F79, 2F79) (Ref. 34-11-10)
- 2 airspeed indicators (1F81, 2F81) (Ref. 34-11-10)
- 2 machmeters (1F80, 2F80) (Ref. 34-11-10)
- 2 vertical speed indicators (1F85, 2F85) (Ref. 34-11-10)
- 2 temperature indicators (1F82, 2F82) (Ref. 34-11-10)
- 2 angle of attack indicators (1F83, 2F83) (Ref. 34-11-10)
- 1 digital total temperature indicator (3F82) (Ref. 34-11-10)
- 1 digital altimeter (3F79) (Ref. 34-11-10)
- 1 digital machmeter (3F80) (Ref. 34-11-10)

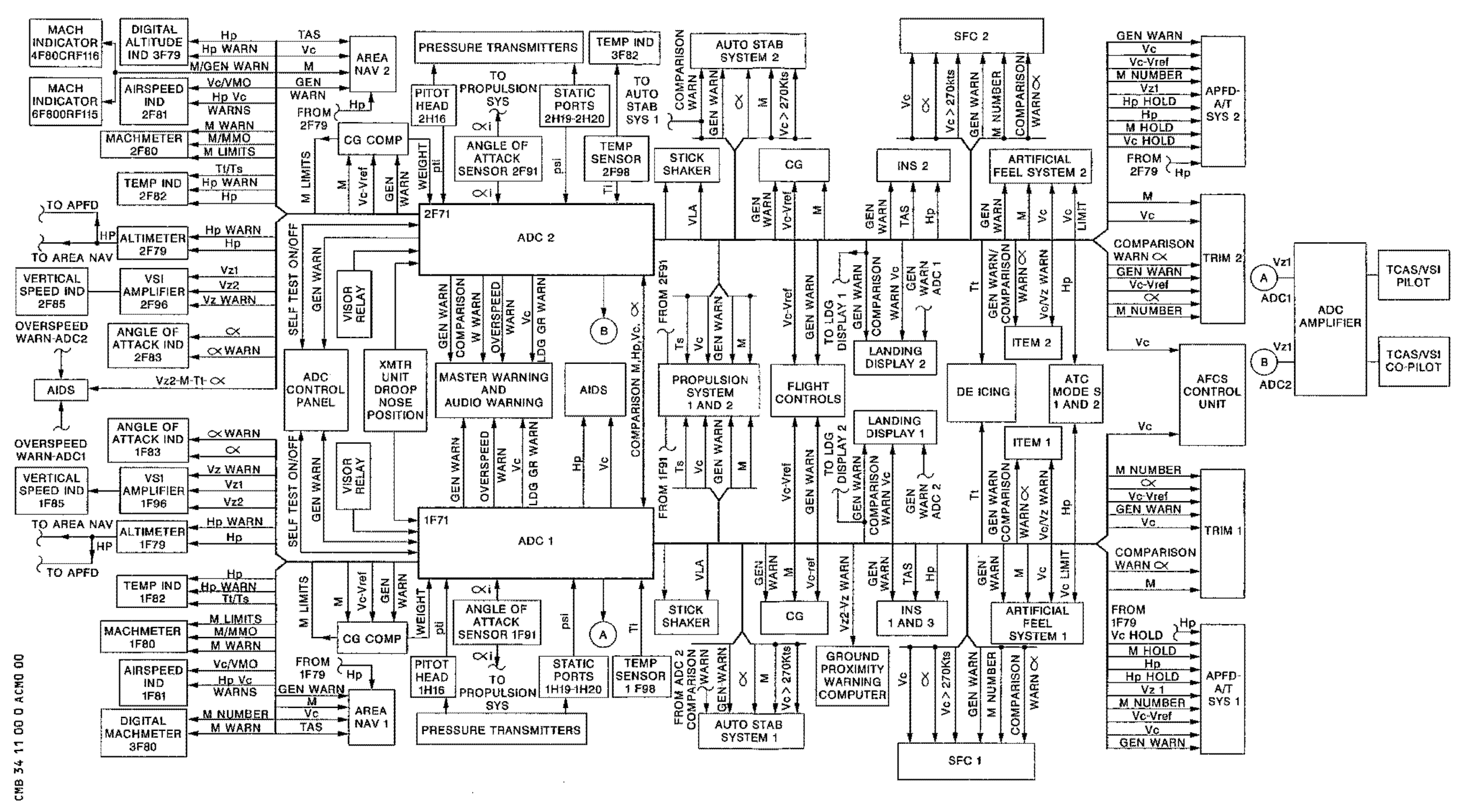
R

- 2 cabin mach indicators (6F80, 4F80) (Ref. 34-11-10)

R
R
- 1 ADC Amplifier (S94) with 2 TCAS VSI (S88)(S87) (Ref. 34-43-00)



Normal Air Data Instrumentation :
Pneumatic Supply
Figure 001



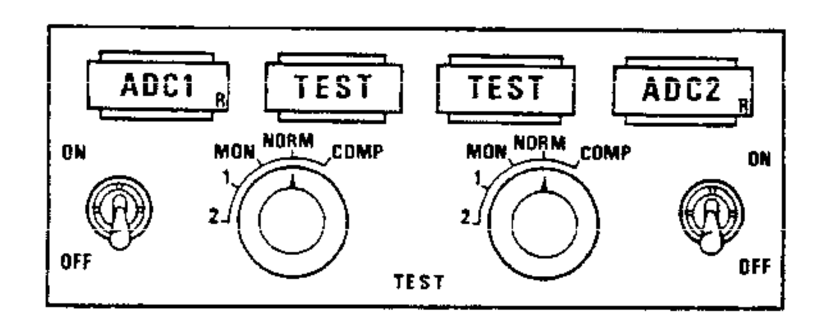
General Block Diagram
Figure 002

B. External System

The system consists of :

- 3 pressure transmitters
- peripheral circuits such as the APFD, ATC, master warning.

3. ADC Control Panel (Ref. Fig. 003)



CMA 34 11 00 0 AGM0

ADC Control Panel
Figure 003

A. Description

The ADC control panel on centre console 9-211 consists of :

(1) two ON-OFF switches

(2) Two ADC 1 and ADC 2 warning lights with RESET device.

(3) Two five position test selector switches.

(4) Two TEST indicator lights with audio cancel device.

B. Operation

(1) ON-OFF switch

Each switch enables energization of the computer and associated instruments.

(2) Test selector switches

Positions of each selector :

- COMP test : check of comparison circuits
- NORMAL : inhibits self test
- MON test : check of internal monitor circuits
- Test 1 : Simulation of a subsonic flight condition
- Test 2 : Simulation of a supersonic flight condition

The last three test positions are inhibited in flight.

(3) ADC warning lights

ADC1 or ADC2 amber warning light illuminates when the general warning is activated by the internal monitor of the corresponding computer (Hp, M, Vc or alpha fault) or by MON test. The warnings activated by the monitors are memorised and when the fault has disappeared they can be cancelled by RESET operation by pressing the appropriate ADC1 or ADC2 indicator light.

(4) TEST indicator lights

Blue TEST indicator light illuminates during test 1 or 2 (precision check of Hp, VB, M, alpha and Tt calculation), MON test (Internal Monitor Integrity), or COMP test (comparator integrity). Tests 1 and 2 define the parameters which activate the overspeed warning, which can be cancelled by pressing TEST indicator light (audio cancel is only possible during test 1 or test 2).

4. ADC Operation

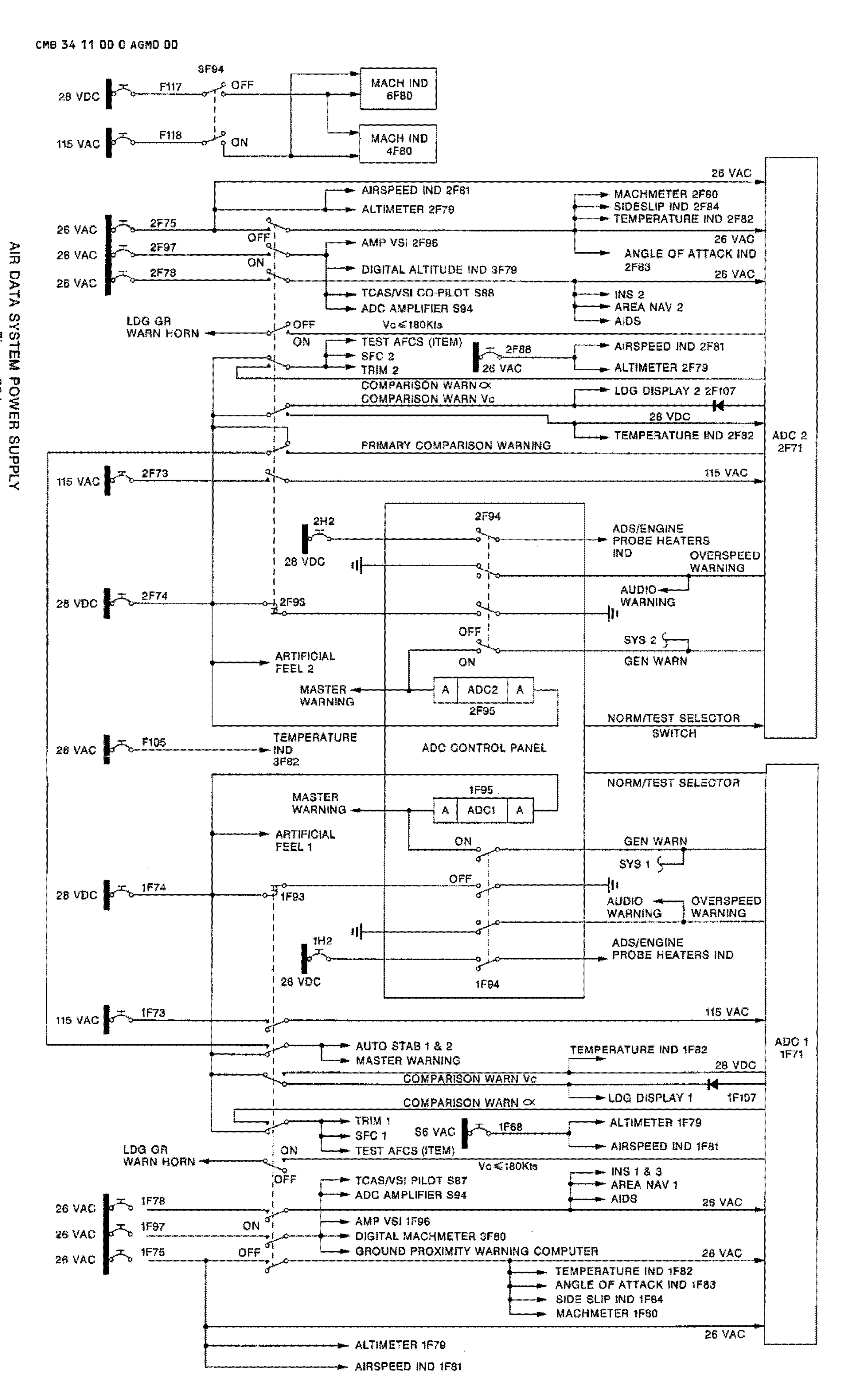
R **ON A/C 006-007,

A. Air Data System Power Supply (Ref. Fig. 004)

The two machmeters (F115) and (F116) in the passenger
R compartment are supplied through circuit breakers (F117),
R panel 15-216 for 28VDC, and (F118), panel 13-216 for 115VAC.
The machmeters are switched on by CABIN MACH INDICATORS
R switch (3F94) on steward panel 1-221.

R

EFFECTIVITY: 006-007
BA



AIR DATA SYSTEM POWER SUPPLY
Figure 004

R **ON A/C 001-005,

A. Air Data System Power Supply (Ref. Fig. 005)

The two mach indicators (6F80) and (4F80) in the passenger compartment are supplied through circuit breakers 3F74, panel 15-216 for 28 VDC and 3F73, panel 13-216 for 115 VAC. The mach indicators are switched on by CABIN MACH INDICATORS switch 3F94 on steward panel 1-221.

(1) Computer and indicator power supply.
The complete system is supplied by :

- 26 VAC 400 Hz, from circuit breakers 1F75, 2F75, 1F97, 2F97, 1F78, 2F78, 1F88, 2F88, F105.
- 28 VDC from circuit breakers 1F74, 2F74.
- 115 VAC 400 Hz from circuit breakers 1F73, 2F73.

(2) Switch on

The system is switched on at the ADC control panel, centre console 9-211, by placing switches 1F94 for ADC1 and 2F94 for ADC2 in ON position.
Relays 1F93 and 2F93 enable :

- Distribution of power supply voltages to the air data computers, indicators and systems connected to the ADC.
- Switching of ADC warning outputs to appropriate circuits.
  Voltages supplied to the computers are used for SYNCHRO and internal power supplies.

The position of the test selector switches enable normal or self test operation. If during start up procedure, one of the ADC indicator lights is illuminated, carry out a RESET by pressing the indicator light to extinguish.

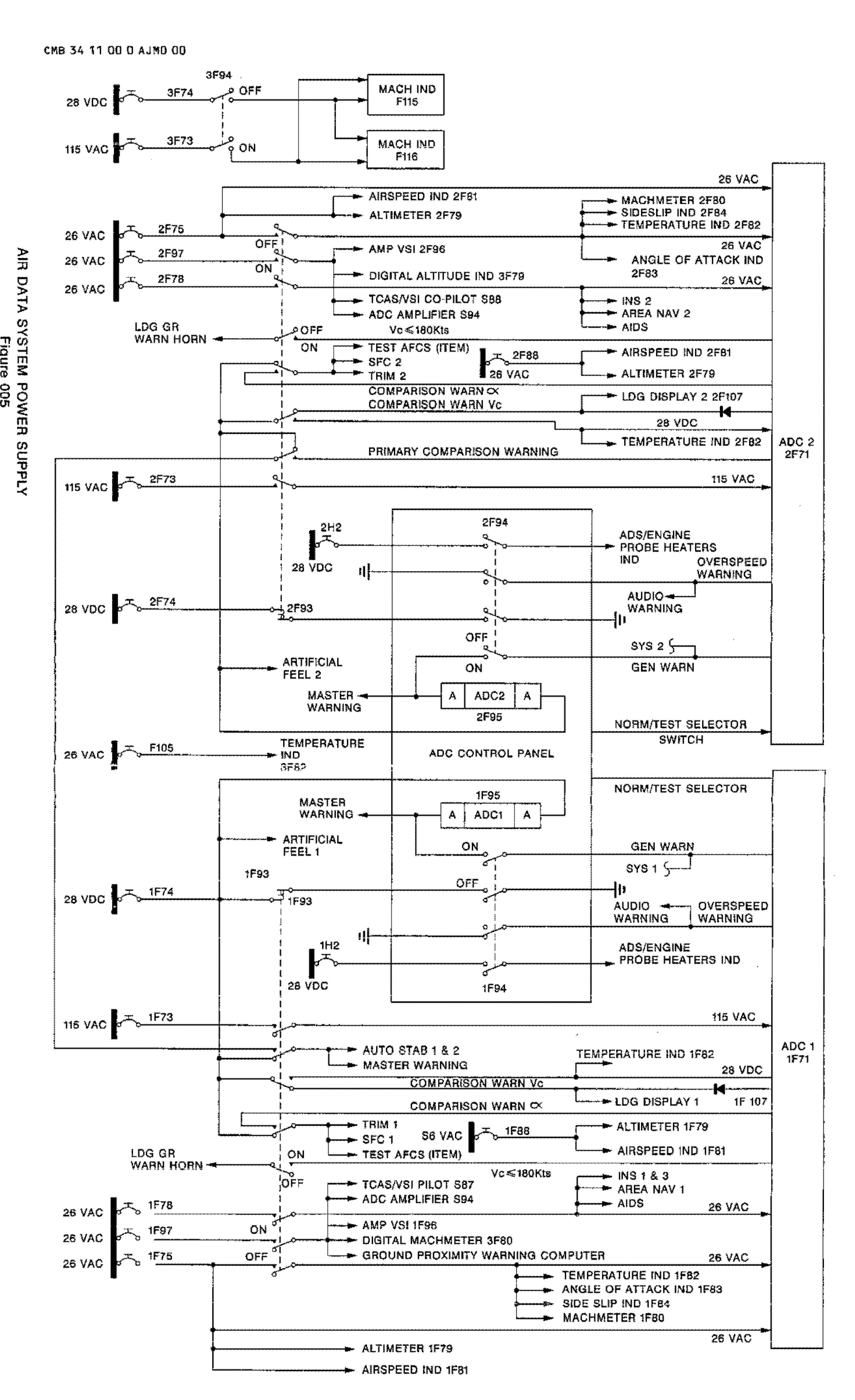
B. Altitude and Vertical Speed Channels (Ref. Fig. 006)

(1) ADC1 altitude channel

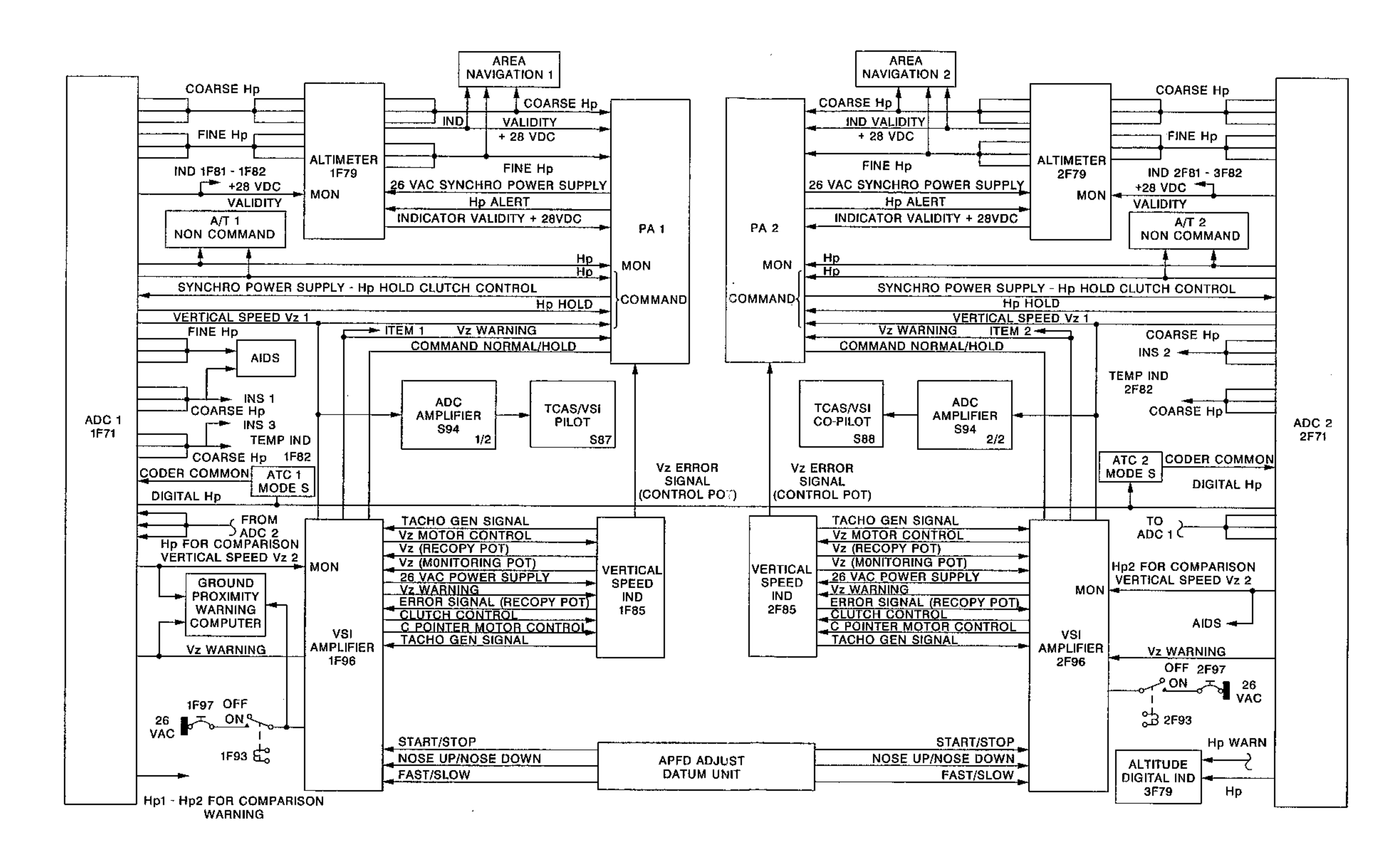
The Hp outputs are generated by devices mechanically driven by the motor generator in the computer altitude module.
ADC1 computer transmits by means of synchros supplied from circuit breaker (1F75), "fine" and "coarse" altitude information to altimeter (1F79) to provide display of aircraft altitude. This information is repeated by synchros at the altimeter output to AP1 and AREA

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AIR DATA SYSTEM POWER SUPPLY
Figure 005



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Hp AND Vz CHANNELS-BLOCK DIAGRAM
Figure 006

NAVIGATION 1. AP1 sends to the altimeter the synchro supply voltage and the amber altitude alert warning light signal. The warning light illuminates when indicated altitude approaches within 1200 ft of the altitude selected on the AFCS controller. It extinguishes when the difference between indicated and selected altitude is less than plus or minus 300 ft. After capture (that is when the difference has once been less than plus or minus 300 ft), if indicated altitude deviates by more than 300 ft from selected altitude, the indicator light flashes as long as the difference between selected and indicated altitude is between 300 and 1200 ft.
The computer sends a + 28 VDC validity signal to the airspeed indicator (1F81), temperature indicator (1F82) and altimeter (1F79). This signal is sent to the altimeter monitor, loss of the signal (Hp warning) causes appearance of a flag. Appearance of the flag can also indicate a fault in the instrument, if ADC1 general warning is not activated, the fault is in the altimeter.
All faults detected by the monitor will cut off the + 28 VDC indicator validity signal sent to AP1 and to AREA NAV1.
Two potentiometer outputs transmit Hp information to the command and monitoring inputs on AP1 and AT1.
The synchros give the following outputs :

- A fine Hp output to the recorder and a Coarse Hp output to the recorder and INS1, of which the synchros are supplied from circuit breaker (1F78).
- A Coarse Hp output to INS3 and temperature indicator (1F82), of which the synchro is supplied from circuit breaker (1F75).
- A synchro resolver receives an altitude comparison signal from ADC2.
- An Hp hold output of which the synchro is supplied and clutched from AP1.
  The ADC1 Hp coder receives a ground signal from the ATC circuit to which it sends digital coded altitude.
  The ground is interrupted by the computer monitoring circuit in order to inhibit coding when the ADC1 general warning is activated.
  The altitude limit of operation of the computer is + 65000 ft, but in exceptional circumstances this limit can be exceeded. In this case, as long as Hp exceeds 65,000ft, the computer causes appearance of warning flags on the following instruments : altimeter (1F79), machmeter (1F80, 3F80), vertical speed indicator (1F85), temperature indicator (1F82),

airspeed indicator (1F81).
ADC1 general warning is not activated in order to avoid disconnection of all systems connected to the computer.
When the altitude is reduced below 65,000 ft, the flags automatically disappear. An Hp1 - Hp2 output is used for comparison warning.

(2) ADC2 altitude channel

Operation is identical with that described in paragraph 4B (1) except for routing of the following Hp synchro information :

- A Coarse Hp output to INS2 of which the synchro is supplied from circuit breaker (2F78).
- A Coarse Hp output to temperature indicator (2F82), of which the synchro is supplied from circuit breaker (2F75).
- A synchro resolver sends Hp2 information to ADC1 for altitude comparison.

A potentiometer output supplies Hp information to the digital altimeter (3F79), the Hp warning from this computer is sent to the indicator.

When the altitude reaches 65,000 ft, flags appear on the following instruments : altimeter (2F79), machmeter (2F80), vertical speed indicator (2F85), temperature indicator (2F82) and airspeed indicator (2F81)

(3) ADC1 vertical speed channel

(a) Vz channel

The VSI amplifier (1F96), between computer and indicator, is supplied by 26 VAC from circuit breaker (1F97) when the computer is switched on.
This channel operates by comparison in the VSI amplifier of vertical speed signal Vz1, supplied by ADC1 and sent to AP1, and recopy Vz and tacho signals from the vertical speed indicator (1F85).
The comparison produces a motor control signal and displacement of Vz pointer to the corresponding value. A Vz2 signal is transmitted to the VSI amplifier monitor and to the ground proximity warning computer which also receives Vz warning.
This warning, loss of + 28 VDC ADC1 validity signal is indicated by appearance of a flag on the vertical speed indicator (1F85) controlled by

the VSI amplifier monitoring. If the flag appears without activation of ADC1 general warning, this indicates that the fault is in the instrument.

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R VSI signals are also displayed by the pilots TCAS
R vertical speed indicator (S87) by means of and
R the signal Vz1 transmitted to ADC amplifier (S94-1/2).

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(b) Commanded speed channel

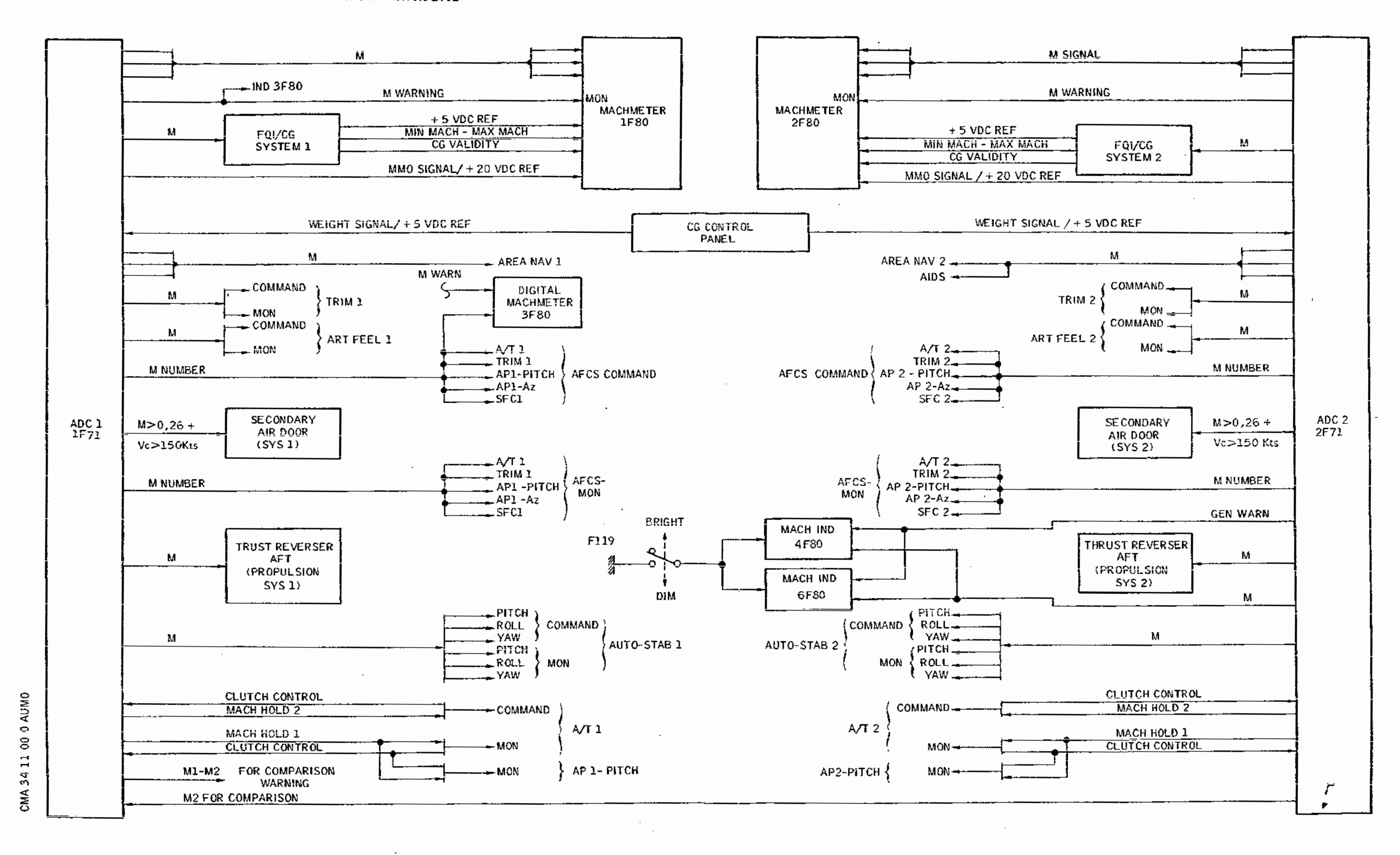
When AP1 sends the NORMAL mode signal to the VSI amplifier, the amplifier receives the error signal resulting from the difference in pointer positions and compares it with the tacho signal. The resultant amplified information signal is used for control of C pointer motor position: the pointer is positioned facing Vz pointer with COMMAND mode signal received from AP1 enabling holding of Vz, C pointer takes up a reference position.
When a difference between pointer positions exists, the vertical speed indicator sends an error signal to AP1 and the corrections made in AP1 enable ADC1 to return Vz to the commanded speed, bringing the pointers into position facing each other.
When a new value is selected, the VSI amplifier receives the required start/stop, nose up/nose down, slow/fast orders from the Datum Adjust Unit according to the selection made. An appropriate signal is sent to the commanded Vz motor and C pointer is displaced to a given speed. With the difference between pointer positions obtained, the system operates in commanded Vz hold mode in order to bring Vz to the new value.

(4) ADC 2 vertical speed channel

(a) Operation of this channel is identical with that described in paragraph 4B (3) except that vertical speed Vz2 and warning Vz signals are only sent to the VSI amplifier (2F96).

R

R VSI signals are also displayed by the co-pilots
R TCAS vertical speed indicator (S88) by means of and the signal Vz1 transmitted to ADC Amplifier (S94-2/2).



Mach and MMO Channels - Block Diagram
Figure 007

The instrument monitor causes appearance of CG flag in case of a loss of + 28 VDC CG validity signal from the centre of gravity circuit.
Calculation of MMO f (Hp, W) is made from Weight Signal and a reference voltage from the FQI control panel. The MMO signal and a reference voltage sent to the machmeter gives a display of MMO.
AREA NAV 1 computer receives an M signal from a synchro supplied from circuit breaker (1F78).
Two potentiometers supplied by trim 1 computer send M information to the computer command and monitoring inputs.
Art feel 1 computer feeds 4 potentiometers which supply M signals for its command and monitoring inputs.
Two M number potentiometer outputs are sent to the command and monitoring inputs of AT1, AP1, TRIM 1 and SFC1 computers.
The ADC1 computer sends a ground signal by means of microswitches to Fire Flaps Control (secondary air door) for M greater than 0.26 m.daN Vc greater than 150 kt.
The propulsion system (TRA) supplies a potentiometer and receives a mach signal.
Six potentiometers supplied by auto-stab 1 computer send M signals to the computer command and monitoring inputs.
Two M Hold synchros are supplied by the AT1 circuit. An M hold 2 output of which the synchro is clutched by AT1 computer, is applied to a command input of the computer.
An M Hold 1 output, of which the synchro is clutched either by AT1 or AP1 computers is applied to the monitoring input of these computers.
ADC1 receives M2 information for mach comparison.
An M1 - M2 output is used for comparison warning.

(2) ADC 2 mach and MMO

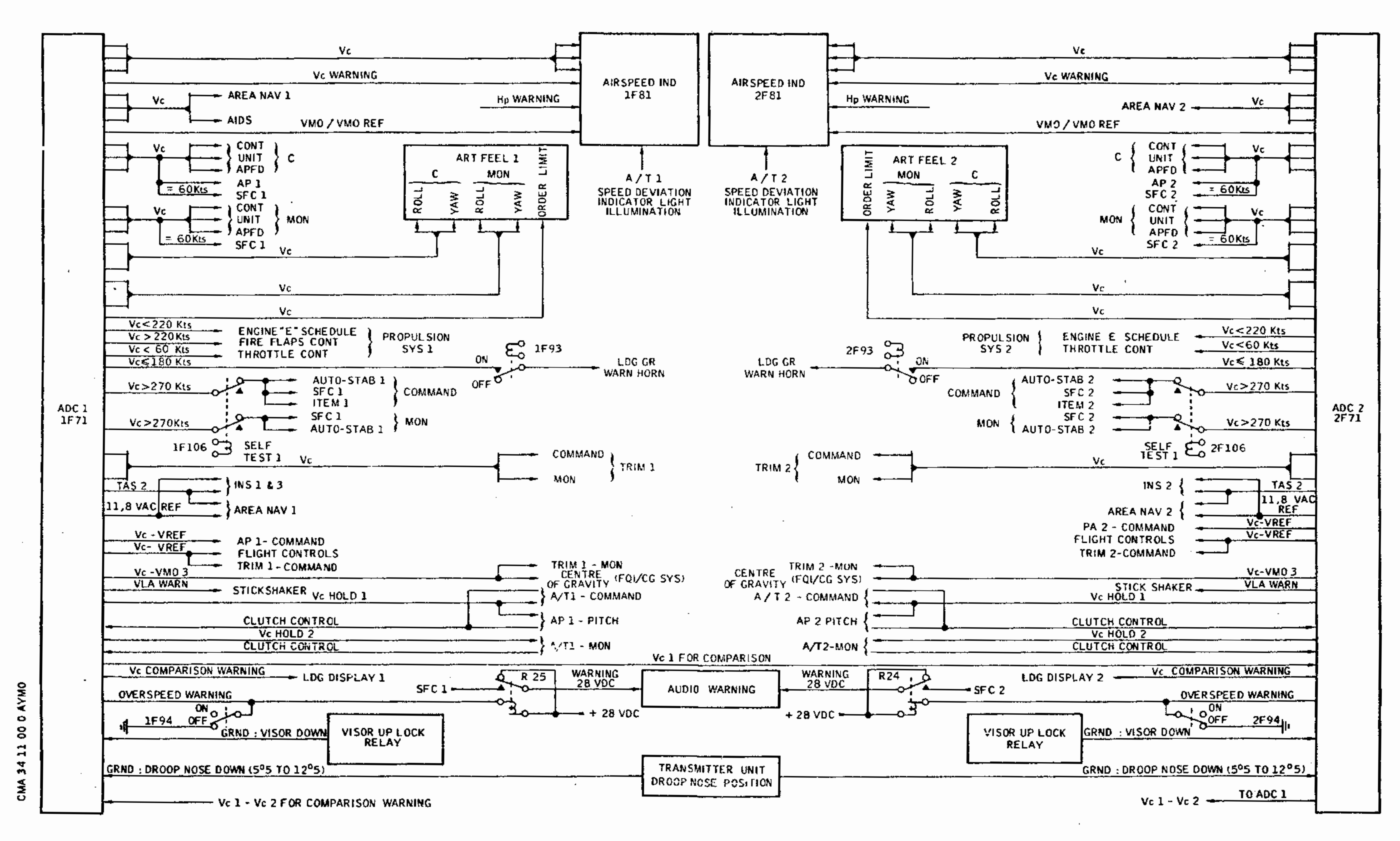
Operation of M and MMO circuit is identical with that described in paragraph 1C (1). The M warning output is sent only to machmeter (2F80). The M signal sent to machmeter comes from a synchro supplied from circuit breaker (2F75).
Area NAV 2 computer receives the M signal from a synchro supplied from circuit breaker (2F78).

D. Vc and VMO Channels (Ref. Fig. 008)

(1) ADC1 Vc and VMO

(a) Distribution of outputs

Vc outputs are generated by devices mechanically driven by the motor generator in the computer Vc module.
ADC1 supplies speed information by means of synchros, potentiometers and microswitches.
Vc information greater or less than operational limit values cause microswitches to close.
The VMO, Vc-VREF, TAS and warning outputs are generated by the computer electronics. Airspeed is displayed by the airspeed indicator from speed information fed to it.
The instrument monitoring circuit receives an ADC1 + 28 VDC validity signal. This signal is cut off when a Vc warning is activated, causing appearance of a flag which masks the airspeed counter.
If the flag appears without activation of ADC1 general warning, the fault is in the indicator.
VMO and VMO REF signals enable display of VMO.
An altitude channel fault (Hp warning) causes appearance of VMO flag. The appearance of this flag without activation of ADC1 general warning indicates an instrument fault.
The amber warning light on the indicator illuminates in case of excessive deviation between indicated airspeed and airspeed selected on the AFCS control panel when the autothrottle is engaged in IAS SELECT mode.
(Threshold : 10 kt).
Two synchros are supplied by the AT1 circuit.
One synchro output provides a Vc signal for the command input to SFC1 and AP1 computers and the AFCS control unit. The second synchro distributes Vc for input monitoring of the SFC1 computer and AFCS control unit.



Vc and VMO Channels - Block Diagram
Figure 008

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The art feel 1 computer supplies four potentiometers which apply Vc signals to the computer command and monitoring inputs. A potentiometer output supplies Vc information for the order Vc unit input of the computer. A microswitch supplied with + 28 VDC by propulsion SYS1 circuit sends this voltage to the circuit when Vc is less than 220 kt.
Two microswitches send ground signals to Fire Flaps Cont circuit for Vc greater than 220 kt and to throttle control circuit (N1 limit) for Vc less than 60Kt.
Two potentiometers supplied by the trim 1 computer send two Vc information signals to the computer command and monitoring inputs.
Two microswitches supplied by auto-stab 1 computer provide two Vc greater than 270 kt information signals to SFC1, ITEM 1 and auto-stab 1 computers, when self-test 1 is not carried out (- 15 VDC at output).
Two synchros supplied from AT1 circuit provide the following outputs :

- A Vc Hold 1 output, of which the synchro is clutched by AT1 or AP1 computers, is sent to the computer command input.
- A Vc Hold 2 output, of which the synchro is clutched by AT1 computer, is sent to the computer monitoring input.

A Vc1 output is transmitted to ADC2 for Vc1 - Vc2 comparison computer 1 receives Vc1 - Vc2 information from ADC2 for comparison warning.
A Vc comparison warning output is sent to Landing Display computer 1.
A synchro sends a Vc signal to AREA NAV 1 computer and to the recorder.

(b) TAS outputs

(b1) The computer circuity generates TAS signals. A TAS 2 output and a reference voltage are sent to INS 2 and 3 and to area NAV 1.

(c) Vc - VMO outputs

The computer supplies three Vc - VMO outputs

- A Vc - VREF output sent to AP1 computer command input.
- A Vc - VMO2 output sent to flight controls

circuit and Trim 1 computer command input.
- A Vc - VMO3 output sent to Trim 1 computer monitoring input and centre of gravity circuit.

(d) Landing gear not extended warning

This warning is activated by a ground signal from the LG circuit. The signal is sent through a stage controlled by a microswitch for Vc less than or equal to 180 kt. It is passed through relay (1F93), ADC1 switch-on, and enables activation of aural warning horn.

(e) Overspeed warning

This warning is generated by the computer as a function of parameters Tt, Vc, M and the position of the droop nose and visor. The warning, activated by removal of the ground at the computer output, enables activation of the warbler aural warning from the audio warning when one of the four following conditions is fulfilled :

- Total temperature exceeds 404°K (131°C), ± 2%.
- IAS exceeds VMO by 6 kt (± 1.6 kt).
- IAS exceeds 270 kt with droop nose lowered (± 2.5 kt).
- Mach exceeds 0.95 with visor down (± 0.008 m).

When the ADC1 on-off switch (1F94) is in OFF position, a ground connection enables energization of relay (R25) in the audio warning circuit in order to maintain monitoring of overspeed warning output from SFC1 computer.

(f) VLA warning

This warning, output from ADC1 as a ground signal, causes activation of the stick shaker and the stall aural warning. It is activated when Vc is less than or equal to VLA 20 kt above 25,000 ft.

(2) ADC2 Vc and VMO

Circuit operation is identical with that described in paragraph 4D (1). A TAS 1 output is not used and TAS2 is sent to INS2 and AREA NAV2 computer.
A synchro output supplies Vc to the AREA NAV 2 computer only.

A Vc less than 60 Kt output is sent to throttle control

circuit (N1 limit).

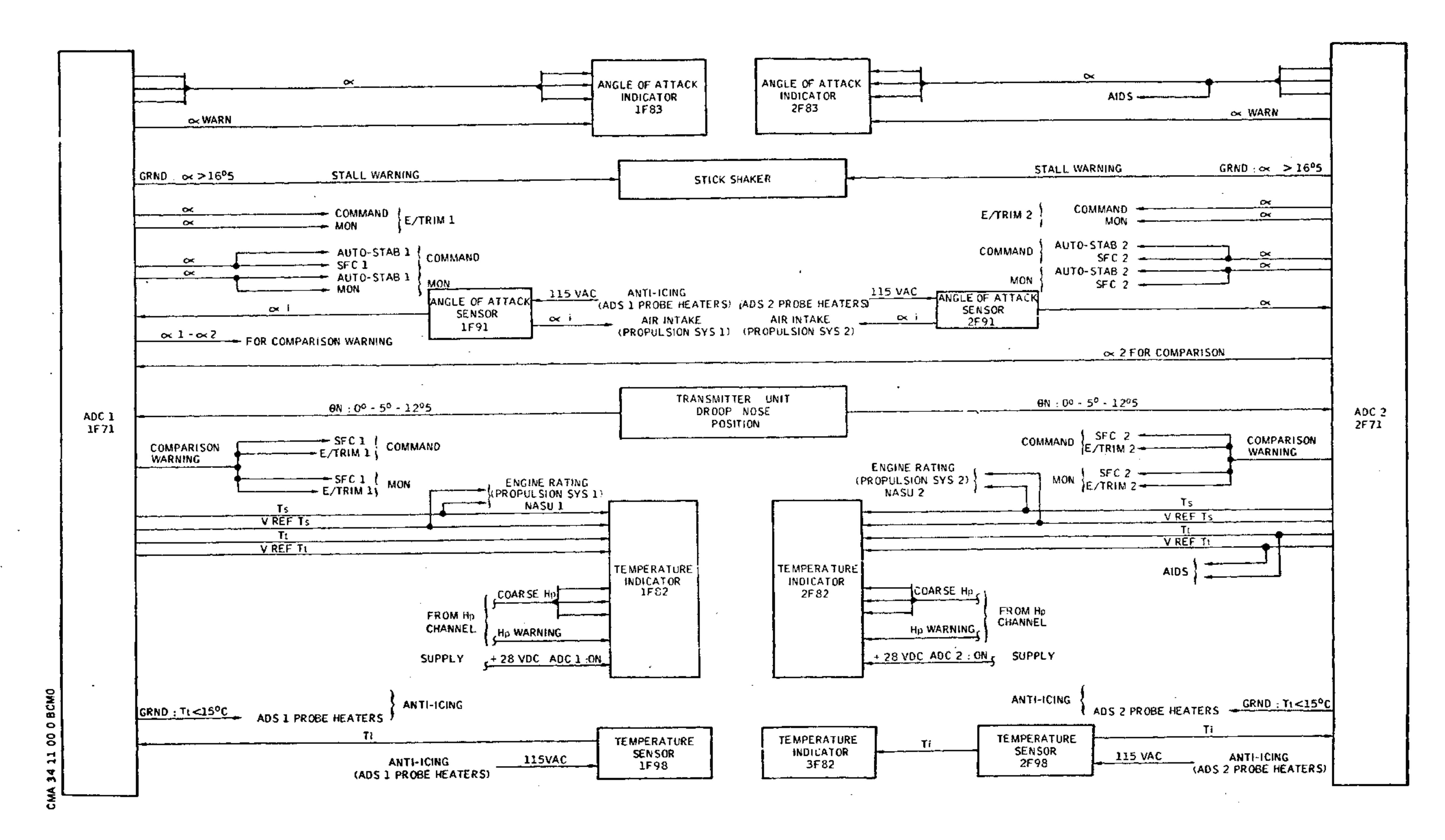
E. Alpha, Tt and Ts Channels (Ref. Fig. 009)

(1) ADC1, alpha, Tt and Ts outputs

(a) Angle of attack (alpha)

Angle of attack calculation is made from alpha i signal, local angle of attack, from a potentiometer controlled by sensor (2F91) vane, and a nose angle position signal (0° -5° -12.5°) from a nose movement potentiometer.
Angle of attack is also a function of mach number.
The sensor also sends by potentiometer an alpha i signal to the engine air intake system. It is heated by a 115VAC power supply. The alpha outputs are produced by means of mechanical connection to the motor generator in the computer IV module.
With the aircraft on the ground, locking of calculation of angle of attack, for Vc less than 95 kt, maintains mechanical connection at Iv = 1° via contact of Vc channel. This contact can be inhibited through de-energization of LG shock absorber relay (G310) for ADC1 and LG relay (G300) for ADC2 (Ref. paragraph 1.4.F. (3) (a) and (b) Test 1). This enables cancellation of Vc less than 95 kt when testing angle of attach sensor (Ref. 34-11-31) and causes tripping of LH UC WEIGHT SW "A" or "B" SYS SUP circuit breakers according to system under test.
The outputs are made by means of synchros and potentiometers.
The angle of attack signal is sent by synchro to angle of attack indicator (2F83) for alpha display and to AIDS.
A + 28 VDC, ADC2 validity signal is sent to the instrument monitor. Loss of the signal, corresponding to alpha warning, causes appearance of a flag on the indicator. Appearance of the flag without activation of ADC2 general warning means that the fault is in the instrument. A microswitch output sends a ground for stick shaker control in case of excessive angle of attack (alpha greater than 16.5°). This output activates the stall warning, operation of stick shaker and aural warning horn.
Trim 2 computer supplies two potentiometers which send to it two alpha information signals for

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Alpha, Tt and Ts Channels - Block Diagram
Figure 009

command and monitoring inputs.
Two potentiometers supplied by auto-stab 2 computer send two alpha information signals to the command and monitoring inputs of this computer and SFC2 computer. The computer sends an alpha 2 signal to ADC1, required for alpha comparison. Alpha comparison warning is sent to command and monitoring inputs pf Trim 2 and SFC2 computers.

(b) Total temperature, static temperature (Tt, Ts)

Calculation of total temperature is made from Ti (impact temperature) information from temperature sensor (2F98). The sensor is heated by a 115 VAC power supply. The various outputs are produced by electronic circuits. ADC2 sends a Tt signal and a reference voltage Tt to temperature indicator (2F82) for display of Tt on a counter. The two outputs are recorded by AIDS.
Loss of + 28 VDC (cut-off ADC2 or power supply fault) causes appearance of Tt flag.
A Tt output is produced by a relay for the following temperature conditions :

- for Tt < 15°C relay energized, output ground applied to anti-icing system (ADS 2 probe heaters).

A Ts signal and a reference voltage Ts are sent to propulsion system No.2 (engine rating) and to the indicator. These signals are used for counter displays of Ts.
Loss of ± 28 VDC Hp warning causes appearance of ISA flag. If the flag appears without activation of ADC2 general warning, the fault is in the instrument.
Display of ISA temperature represents standard altitude f (Hp) minus static temperature.
Temperature sensor (2F98) also sends a Ti signal to temperature indicator (3F82) for digital display of total temperature.

(2) ADC 1, alpha, Tt and Ts outputs

(a) Angle of attack

Operation of the circuit is identical with that described in paragraph 4E (1) (1), except for the alpha output sent to the angle of attack indicator, which is not recorded by the AIDS. A alpha 1 - alpha 2 output is used for comparison

warning.

(b) Total and static temperature

Operation of the circuit is identical with that described in paragraph 4E (1) (b), except for Tt and VREF Tt outputs which are sent to the temperature indicator (1F82) and are not recorded on the AIDS.
Temperature sensor (1F98) is not connected to a temperature indicator.

F. Warnings

(1) Internal monitoring (Ref. Fig. 010)

The internal monitoring of each computer checks continously the 4 servo mechanisms corresponding to altitude (Hp) airspeed (Vc), mach number (m) and angle of attack (alpha) servo channels. The monitoring system checks the error signal level of the servo mechanisms. If an error greater than a given value is detected for a predetermined period, the system concerned activates the following warnings :

- amber ADC warning light on master warning panel.
- ADC1 (1F95) or ADC2 (2F95) warning light on ADC control panel.
- single stroke gong.
= fault indicator flags on the instruments in the following table :

CHANNEL MONITORED	ERROR CAUSING WARNING	INSTRUMENTS ASSOCIATED WITH ADC1	INSTRUMENTS ASSOCIATED WITH ADC2
Altitude	100ft ± 40ft on ground 195ft ± 76ft at 50,000ft (2 seconds ± 0.3)	altimeter (1F79) temperature ind. (1F82) (ISA flag) airspeed ind. (1F81) (VMO flag) Vertical speed ind. (1F85) machmeter (1F80) digital machmeter (3F80)	altimeter (2F79) digital altimeter (3F79) temperature ind. (2F82)(ISA flag) airspeed ind. (2F81) (VMO flag) vertical speed ind. (2F85) machmeter (2F80)
Indicated airspeed	4.5 ± 1.6 kt at 100 kt (2 seconds ± 0.3)	airspeed ind. (1F81) (Vc flag) machmeter (1F80) digital machmeter	airspeed ind. (2F81) (Vc flag) machmeter (2F80)

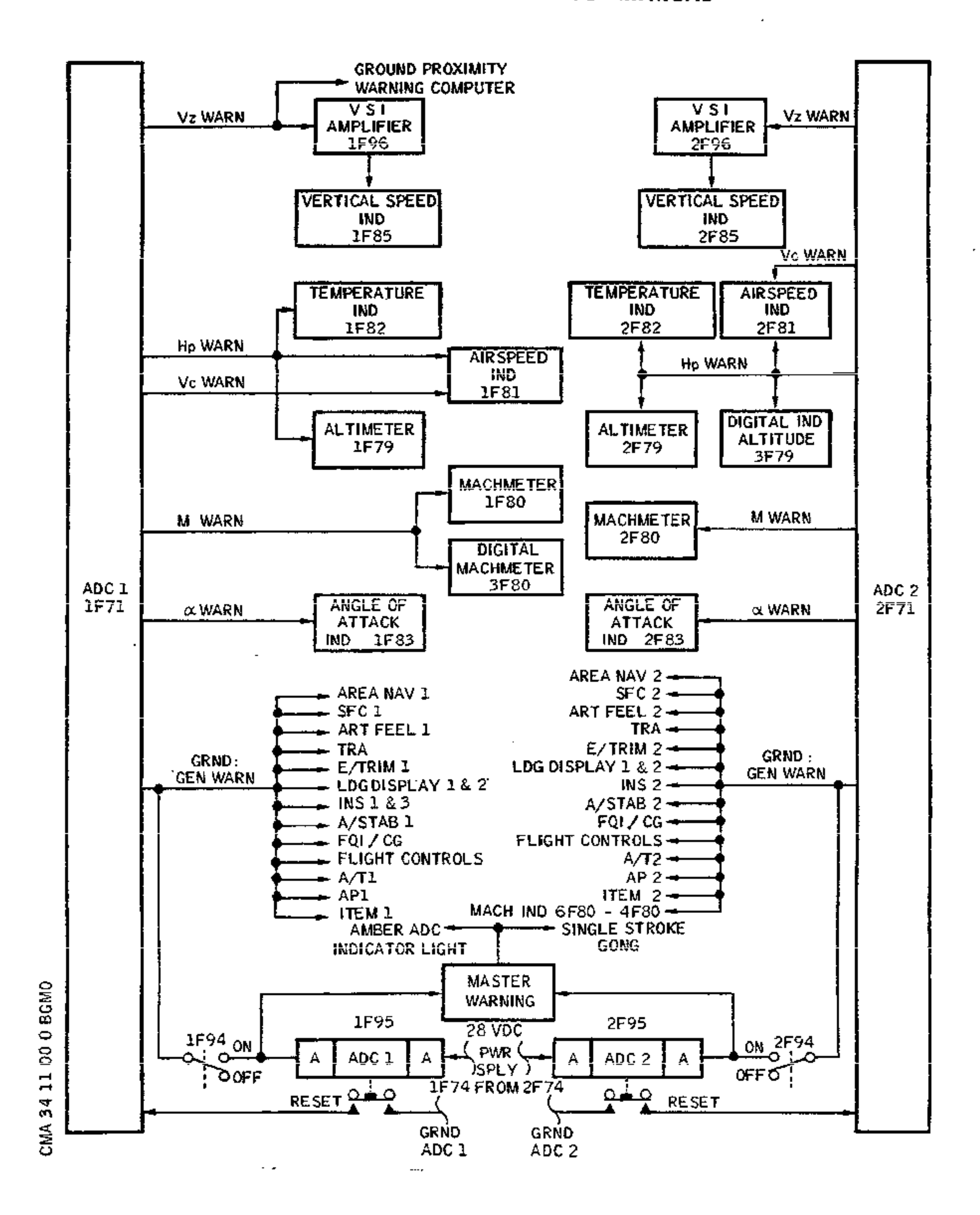
CHANNEL MONITORED	ERROR CAUSING WARNING	INSTRUMENTS ASSOCIATED WITH ADC1	INSTRUMENTS ASSOCIATED WITH ADC2
		(3F80)	
Mach	0.027 ± 0.007 at 0.5 m (2 seconds ± 0.3)	machmeter (1F80) digital machmeter (3F80)	machmeter (2F80)
Angle of attack	1° ± 0.25° (1.1 second ± 0.25)	angle of attack ind. (1F83)	angle of attack ind. (2F83)

The computer activates warnings by inhibition of a + 28 VDC signal concerning one of the Hp, Vc, M or alpha warnings.
Also the general warning is activated simultaneously when one of the four warnings is activated.
The general warning is sent to the systems associated with the computer : SFC1, AP1, Trim 1 etc.
The warnings related to the associated systems are activated at the same time (except in phases of flight during which certain systems do not use ADC information).
Warnings activated by computer monitoring are memorized and cannot be reset until RESET circuit is closed (by pressing ADC1 or ADC2 indicator light on ADC control panel).
Switch-off of the defective computer cancels the warning on the master warning panel and the ADC1 or ADC2 indicator light on the control panel.

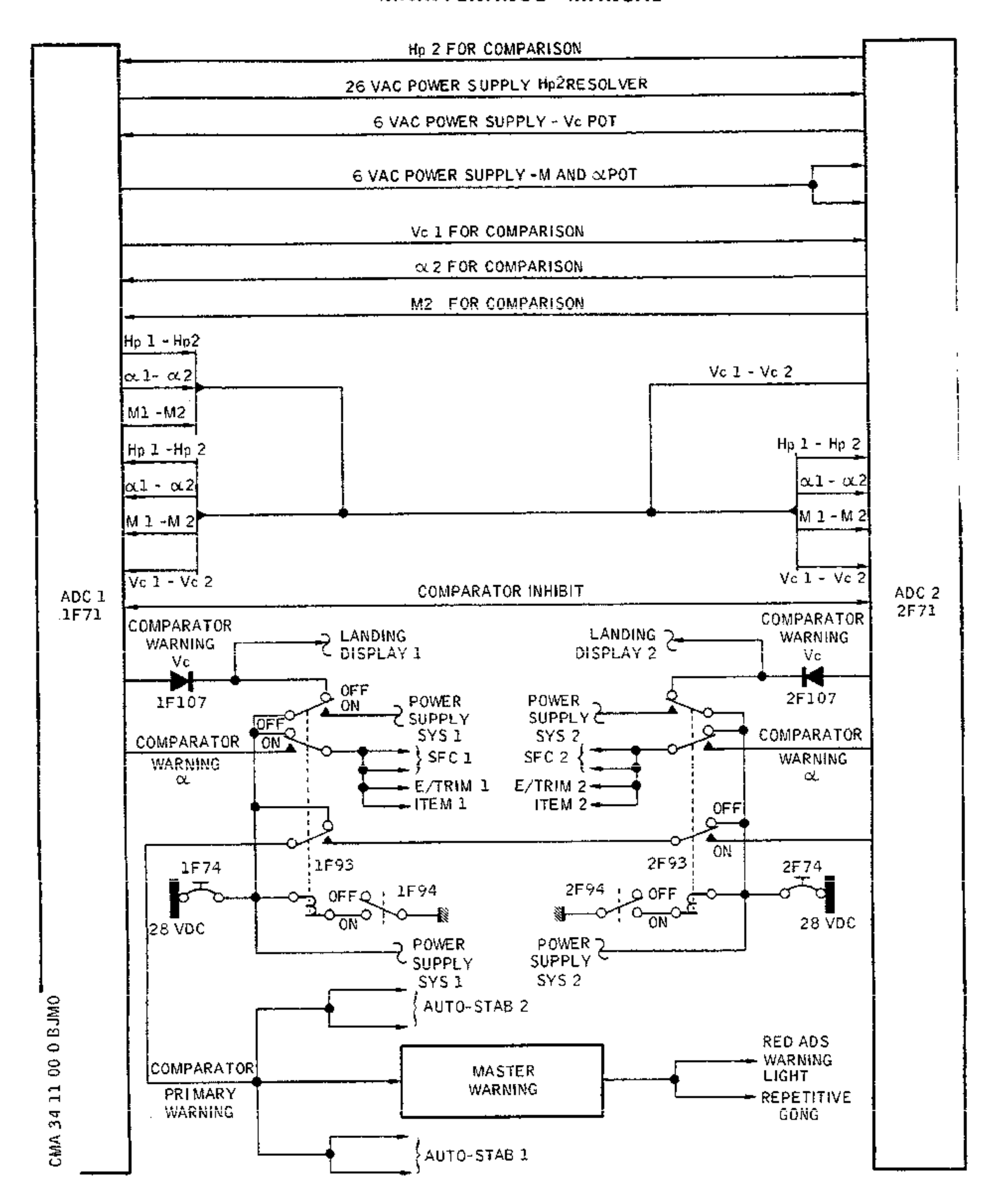
(2) Monitoring by comparison (Ref. Fig. 011)

(a) Monitoring

The internal monitoring checks only correct operation of the servo-mechanisms. It cannot detect faults due to sensors and faults originating after the servo-mechanisms.
To correct this, each computer is equipped with a system of comparison of information supplied by the two computers. A computer has three comparison circuits. Choice of circuits used for the various parameters is made by aircraft wiring. Information required for comparison is obtained at each compu-



Distribution of Warnings
Figure 010



Comparison Warnings
Figure 011

ter by M, alpha and Vc potentiometers and by altitude resolvers.
These recopy devices are driven by calculation channel mechanisms.
ADC1 supplies 26 VAC to ADC2 resolver and 6 VAC to the mach and angle of attack potentiometers.
ADC2 supplies 6 VAC to Vc potentiometer on ADC 1.
Except for the Vc comparator warning output, alpha comparator and main comparator warnings are passed through the ADC start up relays.
Hp 1 - Hp 2, alpha 1 - alpha 2, and M1 - M2 comparisons are made in computer 1. Comparison Vc 1 - Vc 2 in computer 2.
The warnings are activated if a deviation greater than a predetermined threshold, given in the following table, is detected during a given period.
When the Hp, Vc, M or alpha threshold is exceeded, the main comparator warning is activated.

PARAMETERS COMPARED	COMPARISON THRESHOLDS	WARNINGS
Pressure altitude	250 ft to 10,000 ft 520 ft to 40,000 ft 800 ft to 60,000 ft (3 seconds ± 0.6 s)	Main comparator warning
Indicated airspeed	17 kt to 50 kt 9 kt from 100 to 200 kt 19.4 kt to 600 kt (3 seconds ± 0.6 s)	Main comparator warning Vc comparator warning Vc flag airspeed indicators (1F81, 2F81)
Mach number	0.07 M from 0.25 M to 2.5 M (3 seconds ± 0.6 s)	Main comparator warning
Angle of attack	3° from -10° to + 25° (1.8 second ± 0.25 s)	Main comparator warning alpha comparator warning

NOTE : Tolerance for values given is ± 20% and values vary linearly between the points given in the above table.

(b) Results

Each computer activates the warnings by cancellation of a + 28 VDC concerning one of the warnings. Warning activation results in :

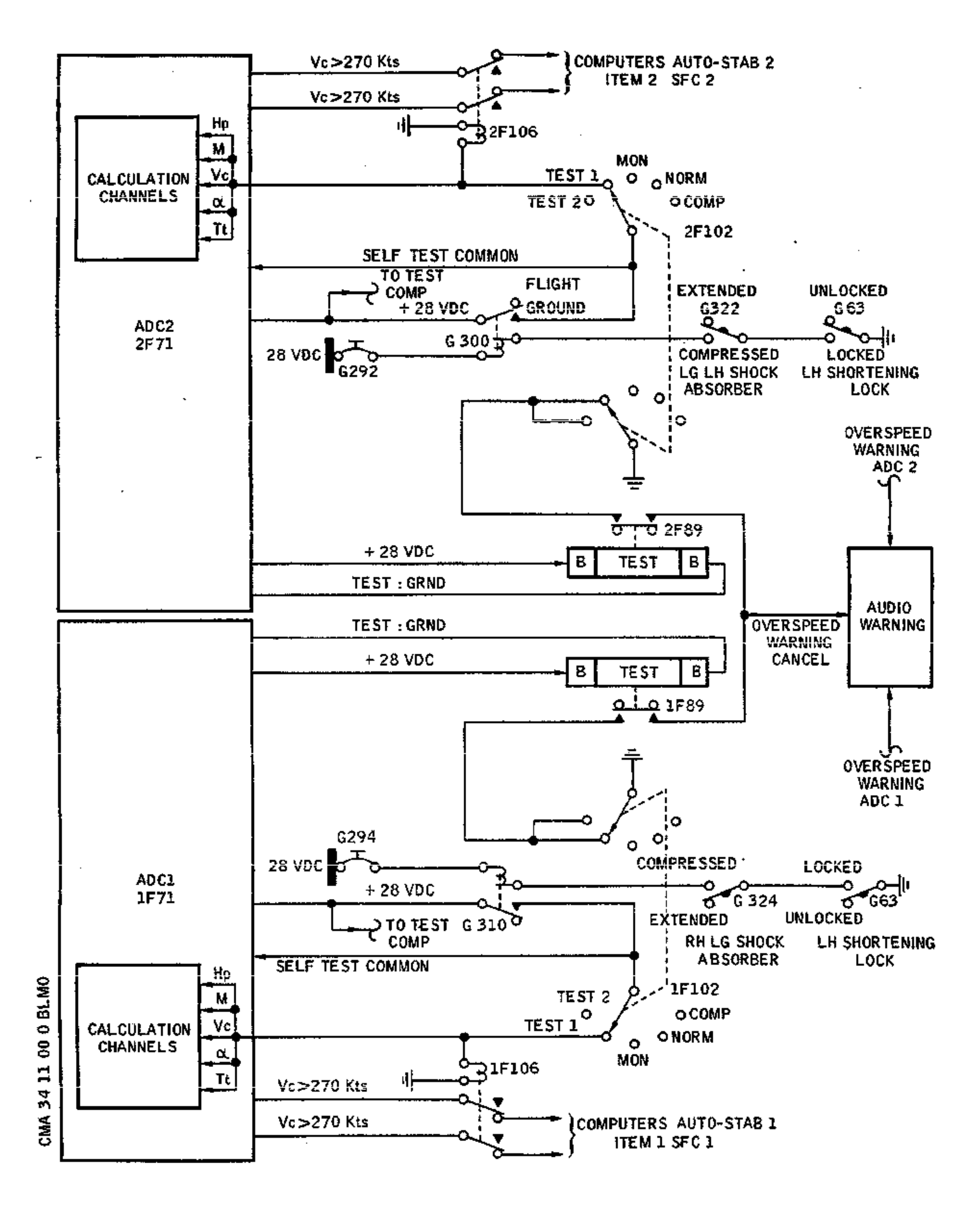
- aural warning (repeater gong)
- illumination of ADS red warning light on master warning panel.
- Change to fixed gains and authority limits of autostabilization systems.
- in case of Vc comparison warning, appearance of Vc flags on airspeed indicators (1F81, 2F81), (activation of Vc warning by monitoring logic), and automatic go around procedure if altitude is less than 600 ft.
- inhibition of anti-high angle of attack devices if warning is due to angle of attack comparison. (SFC1, SFC2 and
- disconnection of electric pitch trim of warning is due to angle of attack comparison and if automatic pilot is not engaged.
  If an Hp, Vc, M or alpha, fault is detected by the computer monitoring logic, it results in the inhibition of comparator warnings.

(3) Computer test

The computers are fitted with a self-testing device. The purpose of the device is to detect, during ground test, all latent computer faults. By simulating pressure inputs and logic conditions, the system enables checking of correct operation of calculation circuits and monitoring systems. The self-tests can be carried out on the two computers.
They are executed by means of selector switches on the ADC control panel.
Self-tests 1 and 2 check two flight conditions, subsonic and supersonic.

(a) Test 1 (Ref. Fig. 012)

Test 1 on ADC 1 is carried out with aircraft on the ground. LG shock absorber relay (G310) is energized in the following conditions :
circuit breaker (G294) set, LH LG shock absorber (G324) compressed, LH shortening lock (G63) locked. In closed position the relay applies a + 28 VDC (self-test common) to the computer, which can be used for execution of tests from the computer front panel. This voltage passes through



Test 1
Figure 012

test 1 position of selector switch (1F102) and controls :

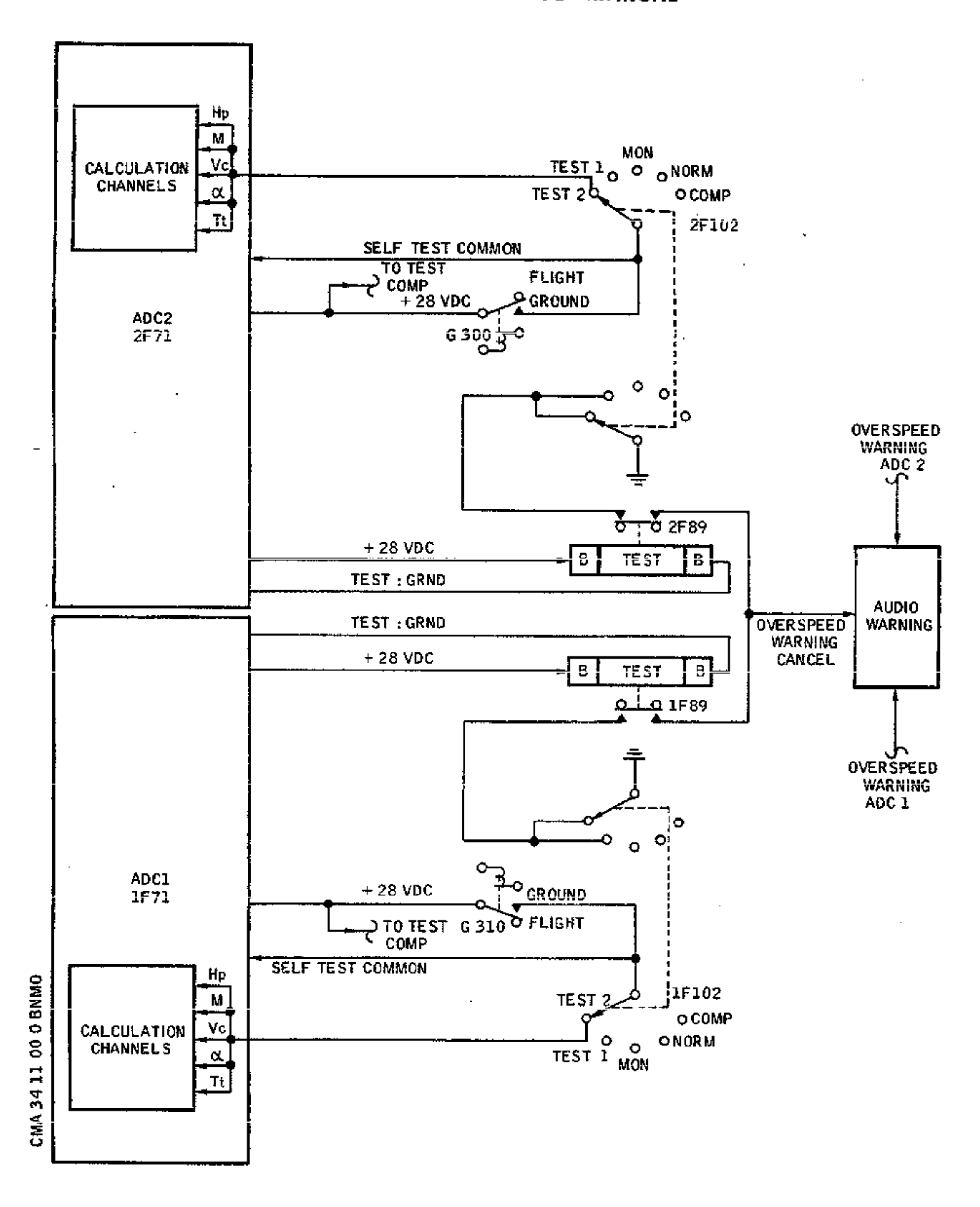
- energization of relay (1F106) cuts the connection from ADC 1 to auto-stab 1, SFC 1, ITEM 1 computers (Vc > 270 kt).
- energization of relays in the Hp, Vc, alpha, M and Tt parameter calculation channels causing simulation of Hp, Vc, alpha, M and Tt parameters to obtain values in the following table :

PARAMETERS	TEST 1
Altitude	10,000 ft
Mach	0.63 M
Angle of attack	21.5°
Calibrated airspeed	350 kt
Total temperature	10°C

If Hp, Vc, M and alpha servo positioning is correct, the test indicator lights on the computer front panel are illuminated. Correct servo control of all four parameters together causes illumination of blue TEST indicator light (1F89) on ADC control panel, by placing a ground in the light circuit.
Information supplied by the computer is sent to associated instruments and circuits as in the preceding descriptions (ref. Hp, Vc, M, alpha and Tt calculation channels).
Self-test 1 operation causes activation of stall warning (alpha > 16.5°). Overspeed warning is also activated (Vc > 270 kt), they can be cancelled by pressing TEST indicator light, which sends a ground to the audio warning.
When test 1 is applied to computer 2, procedure is identical with preceding description and is carried out by means of LG relay (G300) and selector switch (2F102).

(b) Test 2 (Ref. Fig. 013)

Test 2 is carried out on computer 1 as follows :



Test 2
Figure 013

With the aircraft on the ground, LG shock absorber relay (G310) energized (ref. chapter Test 1 4F (3) (a). Sends a + 28 VDC to ADC 1 (self-test common) which enables tests to be performed from the computer front panel.
Test selector switch (1F102) in test 2 position applies this voltage to Hp, Vc, alpha, M and Tt calculation channel switching relays, to obtain simulation of the values in the following table :

PARAMETERS	TEST 2
Altitude	48,000 ft
Mach	2 M
Angle of attack	3.4°
Calibrated airspeed	555 kt
Total temperature	135°C

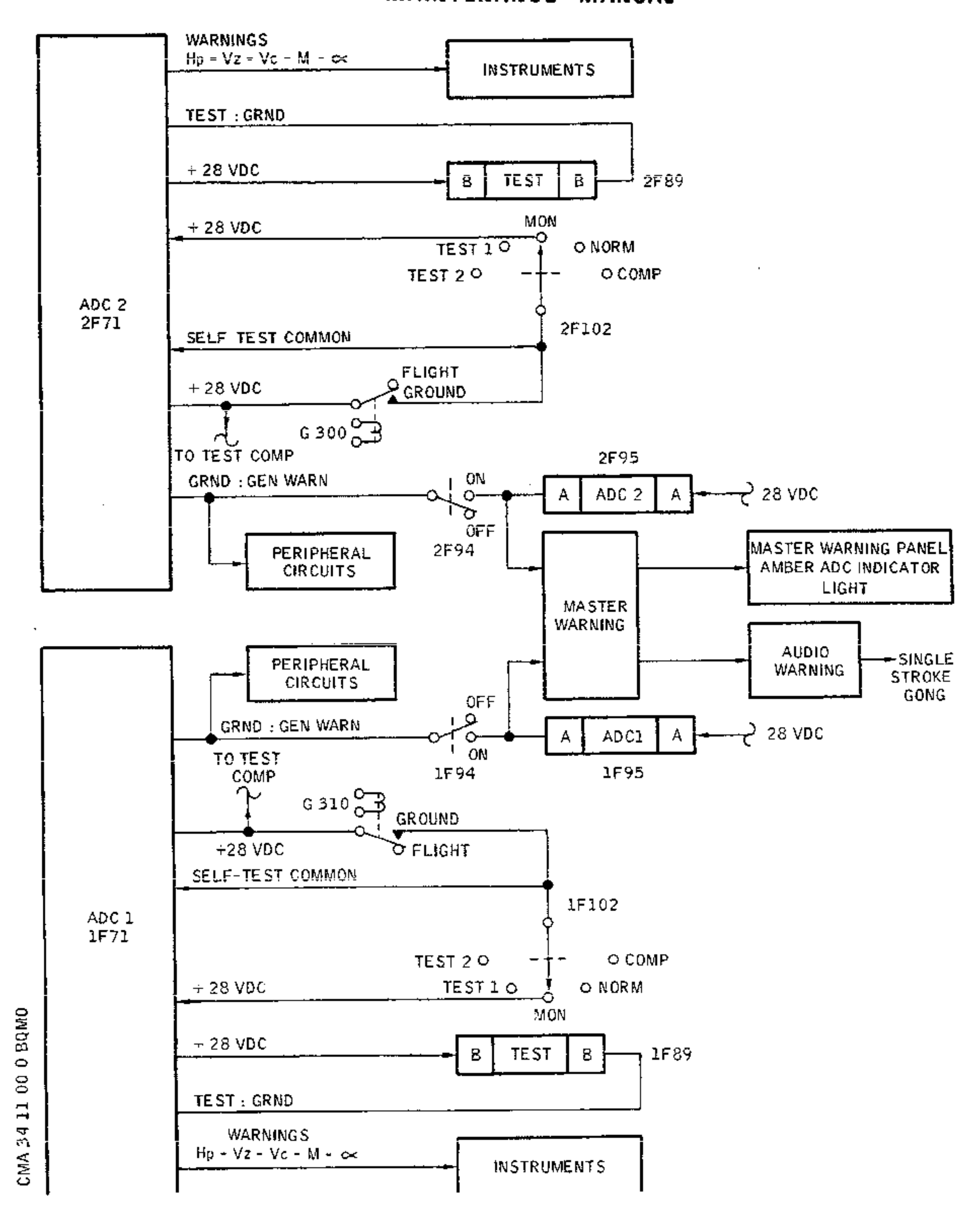
For correct Hp, Vc, M and alpha servo positioning, the computer front panel indicator lights are illuminated. This test introduces Vc, Vc - VMO and Tt values which activate the four overspeed warnings.
Blue TEST indicator light (1F89) illuminates if :

- four conditions of correct servo control are present.
- four overspeed warnings are activated.

Computer output information is sent to the instruments and associated circuits (ref. Hp, Vc, M, alpha and Tt calculation channels). Overspeed warning can be cancelled by pressing TEST indicator light which sends a ground to the audio warning.
Operation of test 2 on ADC 2 is identical with the preceding test and is carried out by means of relay (G300) and selector switch (2F102).

(c) MON test (Ref. Fig. 014)

The purpose of this test is to check the integrity of internal monitoring. It is performed on ADC 1 as follows :



MON Test
Figure 014

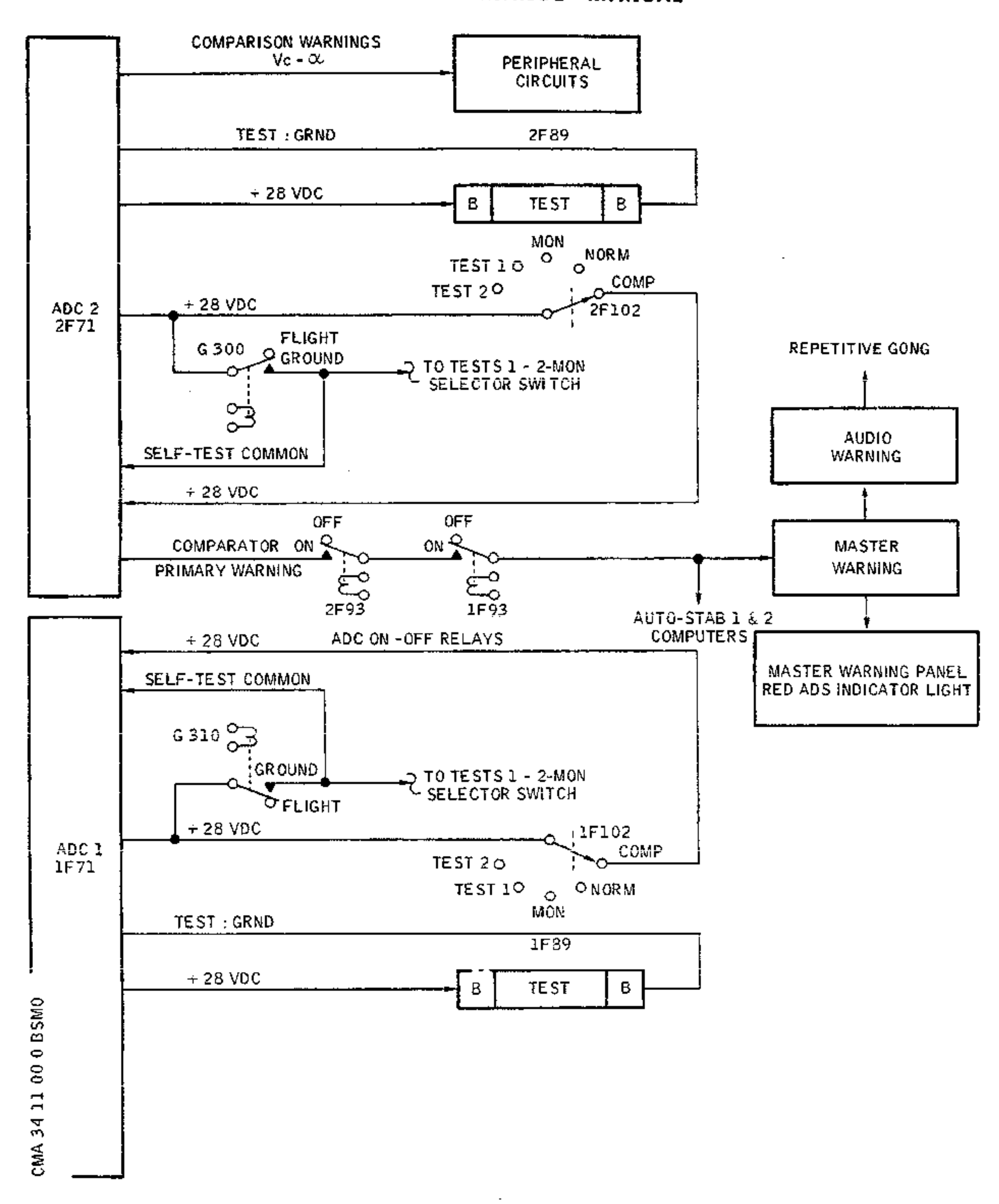
With aircraft on ground, LG shock absorber relay (G318) energized (ref. chapter Test 1 4F (3) (a)). In closed position the relay sends a + 28 VDC to ADC 1 which enables tests to be performed from the computer front panel.
Selector switch (1F102) in MON position sends the + 28 VDC to a switching relay which causes activation of the monitoring circuits.
If the outputs of M, Hp, Vc and alpha channel control and monitoring circuits are correct, the four conditions together cause :

- Illumination of MONIT indicator light on the computer front panel.
- Illumination of blue TEST indicator light (1F89) on ADC control panel.
  Activation of monitoring circuits causes :
  - General warning which controls illumination of amber ADC 1 indicator lights on ADC control panel, amber ADC indicator light on master warning panel, and sounding of single stroke gong.
  - Appearance of warning flags (Hp, Vz, M and alpha warnings) on the instruments and disconnection of associated systems which were engaged. (Ref. warnings chapter 4F (1)). MON test procedure for ADC 2 is identical with the preceding description and is carried out by means of relay (G300) and selector switch (2F102).

(d) COMP test (Ref. Fig. 015)

The purpose of this test is to check correct comparator operation and can be carried out either on the ground by means of LG shock absorber relay (G310) or selector switch (1F102) or in flight using the same selector switch. COMP test is performed on ADC 1 as follows :

On the ground, with LG relay (G310) energized (Ref. chapter Test 1 4F (3) (a)), a + 28 VDC is applied to the computer which enables tests to be carried out from the computer front panel.
Selector switch (1F102) in COMP position sends the + 28 VDC to relays which switch voltages to comparison circuit inputs. They enable activation of Hp, Vc, alpha and M comparators and the four conditions together cause :



COMP Test
Figure 015

- illumination of COMP indicator light on computer front panel.
- illumination of blue TEST indicator light (1F89) on ADC control panel.

  Comparator activation also causes :

  - Appearance of Vc and alpha comparison warnings which are sent to peripheral circuits.
  - Appearance of comparator main warning, indicated by illumination of red ADS warning light on master warning panel, and by sounding of repeater gong.

    (Ref. chapter monitoring by comparison 4F (2) (b)).

    COMP test on ADC 2 is identical with the preceding test and is carried out by means of LG relay (G310) and selector switch (2F102).

(e) NORM position

Tests are inoperative in this position and the computer functions according to information corresponding to flight conditions.

NORMAL AIR DATA COMPUTATION - TROUBLE SHOOTING

WARNING : OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified.

The defect can be isolated with the aid of the trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

As ADC1 and ADC2 systems are similar, trouble shooting procedure is described for system 1. Refer to electrical identifiers in parentheses for trouble shooting of system 2.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101) at the end of the topic. The table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Prepare

A. Equipment and Materials

DESCRIPTION	PART NO.
Pressure Generator	
Setting Device - Incidence Probe - Pitch	D925396-001
Simulator - Pressure Sensor	87209455
Adapter - Static Ports	T8751E22783002
Adapter - Static Ports	T8751E22783003

DESCRIPTION	PART NO.
Adapter - Pitot Tube	853BFT025
Blanking Plug - Pitot Tube Drain Port	853BFT026
Access Platform - 4 m (13 ft)	
Electrical Ground Power Unit	

B. Preliminaries

(1) Reset circuit breakers required to operate the two systems (Ref. 34-11-00, Adjustment/Test).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) On centre console 9-211 place LIGHTS/LO-HI-TEST switch L1008 in TEST position.

(5) Check on ADC control panel, centre console 9-211, that blue TEST indicator lights 1F89 (2F89) as well as amber ADC1 (ADC2) warning lights illuminate.

(6) Place L1008 switch in HI position to extinguish warning and indicator lights.

(7) Place ON/OFF switch 1F94, (2F94) in ON position to switch on computer, and TEST SELECTOR switch 1F102 (2F102) in NORM position.

(8) On altimeter 1F79 (2F79) and airspeed indicator 1F81 (2F81), make certain that mode selector knob leaves letter N (Normal) visible.

(9) On altimeter 1F79 (2F79) select by means of barometric set button, pressure of 1013 mb (29.92 in.Hg).

NOTE : Make certain that the ADC1 S17/S18 (LH electronics rack, shelf 6-215, door BS) or ADC2 S16/S19 (RH electronics rack, shelf 6-216, door BS) pressure sealing plug is installed.

3. Trouble Shooting

```
*************************************************
* Carry out reset by pressing warning light ADC1 *
* [1] (ADC2) [2]).                               *
* Check that all ADC warnings are cancelled. IF  *
*************************************************
     ||     |
     ||     |          ------------------------------------------------------
     ||     |          | On master warning panel, on 4-211, amber ADC       |
     ||     |          | warning light illuminates and single stroke        |
     OK     |-NOT OK-| gong sounds without illumination of amber ADC1     |
     ||     |          | [1], (ADC2 [2]) warning light. All flags remain    |
     ||     |          | visible. Replace circuit breaker [3] ([4]).        |
     ||     |          ------------------------------------------------------
     ||     |          ------------------------------------------------------
     ||     |          | Illumination of amber ADC warning light and        |
     ||     |-NOT OK-| sounding of single stroke gong. Illumination of    |
R    ||     |          | amber ADC1 [1], (ADC2 [2]) warning light. Flags    |
     ||     |          | on all indicators.                                 |
     ||     |          |          Ref. Chart 101.                           |
     ||     |          ------------------------------------------------------
     ||     |          ------------------------------------------------------
     ||     |          | Flags on all indicators except vertical speed      |
     ||     |-NOT OK-| indicators [17] ([18]).                            |
     ||     |          |          Ref. Chart 102.                           |
     ||     |          ------------------------------------------------------
     ||     |          ------------------------------------------------------
     ||     |          | Incorrect comparison warning producing :           |
     ||     |-NOT OK-| Illumination of red ADS warning light on master    |
     ||     |          | warning panel and sounding of repeater gong.       |
     ||     |          |          Ref. Chart 103.                           |
     ||     |          ------------------------------------------------------
     ||     |          ------------------------------------------------------
     ||     |          |          (For altitude fault)                      |
     ||     |          | Illumination of amber ADC warning light and        |
     ||     |          | sounding of single stroke gong. Illumination of    |
     ||     |          | amber ADC1 [1] (ADC2 [2]) warning light.           |
     ||     |          | Flags on the following instruments : altimeter     |
     ||     |-NOT OK-| [19], ([20]), temperature indicator [25],         |
     ||     |          | ([26]) airspeed indicator [21], ([22]), verti-     |
     ||     |          | cal speed indicator [17], ([18]), machmeter        |
     ||     |          | [27], ([28]), digital machmeter [29], digital      |
     ||     |          | altimeter [36]. Trip circuit breaker [3],          |
     ||     |          | ([4]). Replace ADC computer [5], ([6]).            |
     ||     |          ------------------------------------------------------
```

```
 ||      |            --------------------------------------------------
 ||      |           |          (For CAS fault)                          |
 ||      |           | Illumination of amber ADC warning light and       |
 ||      |           | sounding of single stroke gong. Illumination of   |
 ||      |           | ADC1 [1], (ADC2 [2]) amber warning light.         |
 OK      |-NOT OK-   | Flags on following instruments : airspeed indi-   |
 ||      |           | cator [21], ([22]), machmeter [27], ([28]),       |
 ||      |           | digital machmeter [29].                           |
 ||      |           | Trip circuit breaker [3], ([4]). Replace          |
 ||      |           | ADC computer [5], ([6]).                          |
 ||      |            --------------------------------------------------
 ||      |            --------------------------------------------------
 ||      |           |          (For mach fault)                         |
 ||      |           | Illumination of amber ADC warning light and       |
 ||      |           | sounding of single stroke gong.                   |
 ||      |           | Illumination of amber ADC1 [1], (ADC2 [2]) war-   |
 ||      |-NOT OK-   | ning light.                                       |
 ||      |           | Flags on following instruments : machmeter        |
 ||      |           | [27], ([28]), digital machmeter [29].             |
 ||      |           | Trip circuit breaker [3], ([4]).                  |
 ||      |           | Replace ADC computer [5], ([6]).                  |
 ||      |            --------------------------------------------------
 ||      |            --------------------------------------------------
 ||      |           |          (For angle of attack fault)              |
 ||      |           | Illumination of amber ADC warning light and       |
 ||      |           | sounding of single stroke gong.                   |
 ||      |           | Illumination of amber ADC1 [1], (ADC2 [2]) war-   |
 ||      |-NOT OK-   | ning light.                                       |
 ||      |           | Flags on following instruments : angle of at-     |
 ||      |           | tack indicator [37], ([38]).                      |
 ||      |           | Trip circuit breaker [3], ([4]).                  |
 ||      |           | Replace ADC computer [5], ([6]).                  |
 ||      |            --------------------------------------------------
 ||      |            --------------------------------------------------
 ||      |           | Flag on one indicator only on Captain (First      |
 ||      |-NOT OK-   | Officer) instrument panel except vertical speed   |
 ||      |           | indicator [17], ([18]).                           |
 ||      |           |          Ref. Chart 104.                          |
 ||      |            --------------------------------------------------
 ||      |            --------------------------------------------------
 ||      |-NOT OK-   | Flag on vertical speed indicator [17].            |
 ||      |           |          Ref. Chart 105.                          |
 ||      |            --------------------------------------------------
 ||      |            --------------------------------------------------
R ||     |-NOT OK-   | Flag on vertical speed indicator ([18]).          |
 ||      |           |          Ref. Chart 106.                          |
 ||      |            --------------------------------------------------
 ||      |            --------------------------------------------------
 ||      |-NOT OK-   | Overspeed warning : activation of WARBLE aural    |
R ||     |           | warning. Ref. Chart 107.                          |
 ||      |            --------------------------------------------------
```

```
    ||
    ||
*******************************************************************
* Carry out monitoring test by placing test selector              *
* switch [52], ([53]) on ADC control panel in MON                 *
* position. The test causes :                                     *
* - On ADC control panel, illumination of TEST [54],              *
*   ([55]) and ADC1 [1], ([2]) indicator lights.                  *
* - Activation of general warning : single stroke gong            *
*   and illumination of amber ADC warning light on                *
*   master warning panel.                                         *
* - Appearance of flags on indicators, except Ts and              *
*   Tt flags on temperature indicator [25], ([26]).               *
* - Illumination of MONIT indicator light on computer             *
*   front panel [5], ([6]). (Reminder information). IF            *
*******************************************************************
    ||      |        ------------------------------------------------
    ||      |        |         Test does not operate.               |
    ||      |-NOT OK-|            Ref. Chart 108.                   |
    ||      |        ------------------------------------------------
    ||      |        ------------------------------------------------
    ||      |        | Blue test indicator light [54], ([55]) does not|
    ||      |        | illuminate.                                  |
    ||      |-NOT OK-| Trip circuit breaker [3], ([4]).             |
    ||      |        | Replace ADC computer [5], ([6]).             |
    ||      |        ------------------------------------------------
    ||      |        ------------------------------------------------
    ||      |-NOT OK-| General warning incorrect.                   |
    ||      |        |          Ref. Chart 109.                     |
    ||      |        ------------------------------------------------
    ||      |        ------------------------------------------------
    ||      |        | No flags visible on indicators but ADC1 [1], |
    ||      |-NOT OK-| (ADC2 [2]) warning light is illuminated.     |
    ||               | Replace indicator.                           |
R   ||               | (Ref. 34-11-29, Removal/Installation).       |
    ||               ------------------------------------------------
    ||
    ||
    ||
    ||
    OK
    ||
    ||
```

```
**************************************************
* Carry out test 1 by placing test selector switch *
* [52], ([53]) in TEST 1 position. The test causes:*
* - Illumination of TEST indicator light [54],     *
*   ([55]) on ADC control panel                    *
* - Shaking of Captain and First Officer control   *
*   columns and activation of aural warning (stall *
*   warning).                                      *
* - Display of the following flight parameters :   *
*   altimeter [19], ([20]) Hp 10000 ft. ± 30 ft.   *
*   airspeed indicator [21], ([22]) Vc 350 Kt ± 3  *
*   Kt, machmeter [27], ([28]) M 0.63 ± 0.01, angle*
*   of attack indicator [37], ([38]) alpha 21.5°   *
*   ± 0.5°, temperature indicator [25], ([26]) Tt  *
*   ± 2°, Ts -11° ± 2.5°, T ISA -6.2° ± 3.5°.      *
*   (Mach 0.63 displayed on cabin machmeters [31], *
*   [32]. IF                                       *
**************************************************
     ||        |       |-------------------------------------------
     ||        |       |          Test does not operate             |
     OK        NOT OK--|          Ref. Chart 110                    |
     ||        |        -------------------------------------------
     ||        |        -------------------------------------------
     ||        |       | BLUE TEST indicator light [54], ([55])     |
     ||        NOT OK--| does not illuminate.                       |
     ||        |       | Trip circuit breaker [3], ([4]).           |
     ||        |       | Replace ADC computer [5], ([6]).           |
     ||        |        -------------------------------------------
     ||        |        -------------------------------------------
     ||        |       | BLUE TEST indicator light [54], ([55]) is  |
     ||        NOT OK--| illuminated, a flag or incorrect reading   |
     ||        |       | appears on an indicator.                   |
     ||        |       |         Ref. Chart 111                     |
     ||        |        -------------------------------------------
     ||        |        -------------------------------------------
     ||        NOT OK--| Captain (First Officer) stick shaker does  |
     ||        |       | not operate.                               |
     ||        |       | (Ref. 27-38-00, Trouble Shooting).         |
     ||        |        -------------------------------------------
     ||        |        -------------------------------------------
     ||        |       | No mach indication on the two cabin mach-  |
     ||        NOT OK--| meters [31], ([32]).                       |
R    ||        |       | Ref. Chart 119.                            |
     ||        |        -------------------------------------------
     ||        |        -------------------------------------------
     ||        |       | No mach indication on machmeter [31] or    |
     ||        NOT OK--| [32]. Replace faulty machmeter.            |
     ||                 -------------------------------------------
     OK
     ||
```

```
****************************************************
* Carry out test 2 by placing test selector switch   *
* [52], ([53]) in TEST 2 position. Droop nose must be*
* in 12.5° position and visor lowered.               *
* (Ref. 27-61-00, Adjustment/Test). The test causes :*
* - Illumination of TEST indicator light [54], ([55])*
* - WARBLE aural warning (overspeed warning).        *
* - Display of the following flight parameters : al- *
*   timeter [19], ([20]) Hp 48000 ft ± 120 ft, air-  *
*   speed indicator [21], ([22]) Vc 555 Kt ± 4 Kt,   *
*   machmeter [27], ([28]) M 2 ± 0.01, angle of at-  *
*   tack indicator [37], ([38]) alpha 3.4° ± 0.5°,   *
*   temperature indicator [25], ([26]) Tt 135° ± 2°, *
*   Ts - 46.5° ± 2.5°, T ISA - 8.5° ± 3.5°. IF       *
****************************************************
   ||      |
   OK      |-NOT OK-| Test does not operate.
                    | Ref. Chart 112.

           |-NOT OK-| Blue TEST indicator light [54], ([55]) does not
                    | illuminate.
                    | Ref. Chart 113.

           |-NOT OK-| Blue TEST indicator light [54], ([55]) is illu-
                    | minated. A flag or incorrect reading appears
                    | on an indicator.
                    | Ref. Chart 111.

           |-NOT OK-| Overspeed aural warning (warble) does not ope-
                    | rate Ref. Chart 114.
   ||      |
****************************************************
* Place test selector switch [52], ([53]) in NORM    *
* position. Switch on ADC2 (ADC1) by placing ON/OFF  *
* switch [12], ([11]) in ON position. Comparator main*
* warning is not activated : repeater gong warning   *
* does not sound, ADS red warning light is not illu- *
* minated on master warning panel. IF                *
****************************************************
R  ||      |
   ||      |
   ||      |
```

```
   ||     |         ---------------------------------------------------
   ||     |         | Sounding of repeater gong and illumination of   |
   ||     |         | red ADS warning light. Trip circuit breakers    |
   OK     |-NOT OK-| [4], [16], [24], [46], [69].                     |
   ||               | Remove SFC computer ([8]).                      |
   ||               | Replace ADC power switching relays ([14]).      |
   ||               ---------------------------------------------------
*****************************************************
* Carry out RESET action for ADC2 (ADC1) by pressing *
* ADC2 [2], (ADC1 [1]) warning light.                *
* Check that ADC warnings are cancelled. IF          *
*****************************************************
   ||     |         ---------------------------------------------------
   OK     |-NOT OK-|            Ref. Chart 101 to 107.                 |
   ||               ---------------------------------------------------
*****************************************************
* Carry out comparator test by placing test selector *
* switch [52] ([53]) in COMP position.               *
* Test causes :                                      *
* - Illumination of blue TEST indicator light [54]   *
*   ([55]) on ADC control panel.                     *
* - Activation of comparator main warning : repeater *
*   gong aural warning sounds and red ADS warning    *
*   light illuminates on master warning panel. IF    *
*****************************************************
   ||     |         ---------------------------------------------------
   OK     |-NOT OK-|        Test does not operate.                     |
   ||     |         |           Ref. Chart 115.                        |
   ||     |         ---------------------------------------------------
   ||     |         ---------------------------------------------------
   ||     |         | Blue TEST indicator light [54], ([55]) does not|
   ||     |-NOT OK-| illuminate.                                      |
   ||     |         |           Ref. Chart 116.                        |
   ||     |         ---------------------------------------------------
   ||     |         ---------------------------------------------------
   ||     |-NOT OK-| Comparator main warning is not activated.        |
   ||     |         |           Ref. Chart 117.                        |
   ||     |         ---------------------------------------------------
   ||     |         ---------------------------------------------------
   ||     |         | No flag on airspeed indicator [21] or ([22]).   |
   ||     |-NOT OK-| Trip circuit breaker [3] or ([4]) to replace     |
   ||               | ADC computer [5] or ([6]) associated with air-  |
   OK               | speed indicator on which flag is not visible.   |
   ||               ---------------------------------------------------
```

```
        ||
        OK
        ||
  *****************************************************
  * Start up pressure generator. Ref. functional test *
  * of ADC1 (ADC2) with pressure generator, chapter 2E *
R * (1). (Ref. 34-11-00, Adjustment/Test). For leakage *
  * test use either one of the following procedures :  *
  * (1)Select on generator Ps 70 mb (2.07 in.Hg) and a *
  *    Δp 425 mb (12.56 in.Hg). Turn angle of attack   *
  *    sensor vane [66], ([67]) to obtain 2° reading on*
  *    angle of attack indicator [37], ([38]) and hold *
  *    in this position. Reading on altimeter [19],    *
  *    ([20]) is approximately HP 60800 ft. Isolate    *
  *    the air data system from the pressure generator.*
R *    Ps system, after 5 minutes difference in values *
  *    must not exceed 500 ft. Select Ps 151 mb        *
  *    (4.46 in.Hg) and Δp 600 mb (17.72 in.Hg).       *
  *    Reading on airspeed indicator [21], ([22]) is   *
  *    approximately Vc 543.3 Kt. Isolate the air data *
  *    system from the pressure generator.             *
R *    Pt system, after 10 minutes difference in values*
  *    must not exceed 1 Kt.                           *
  * (2)Select on generator Ps 300 mb (8.86 in.Hg) and  *
  *    ΔP 425 mb (12.55 in.Hg). Turn angle of attack   *
  *    sensor vane [66], ([67]) to obtain reading of   *
  *    2° on angle of attack indicator [37], ([38]) and*
  *    hold in this position. Reading on altimeter     *
R *    [19], ([20]) is Hp 29700 ft and on airspeed in- *
  *    dicator [21], ([22]) Vc 476 Kt. Isolate air     *
  *    data system from generator.                     *
R *    Ps system, permissible leakage 400 ft in 10     *
R *    minutes.                                        *
R *    Pt system, permissible leakage 2 Kt in 10 minu- *
  *    tes. IF                                         *
  *****************************************************
        ||     |
        ||     |         ------------------------------------
        OK     |-NOT OK-| Locate leak in Ps or Pt system    |
        ||              | Replace defective component.      |
        ||               ------------------------------------
        ||
        ||
        ||
```

```
******************************************************
* Install angle of attack sensor setting device on    *
* angle of attack sensor [66], ([67]). Lock the       *
* sensor error correction from the test socket on     *
* front panel of ADC computer [5], ([6]) by shorting  *
* terminal e to terminals V and B, or by means of test*
* simulator by placing Probe Correction Key in Locked *
* position.                                           *
* (1)Make certain that droop nose is in 0° position   *
*    and Visor raised (Ref. 27-61-00, Adjustment/     *
*    Test).                                           *
*    Position angle of attack sensor [66], ([67]) to  *
*    alpha i value of -5.71°. Select on pressure      *
*    generator Ps 94.54 mb (2.8 in.Hg) and Δp 479.35mb*
*    (14.16 in.Hg). Check following values on         *
*    instruments :                                    *
R *    - altimeter [19], ([20]) Hp 54245 ft ± 160 ft.   *
*    - airspeed indicator [21], ([22]) Vc 506 Kt ± 4Kt*
*    - machmeter [27], ([28]) M 2.08 ± 0.02           *
*    - angle of attack indicator [37], ([38]) alpha   *
*      2° ± 0.5°.                                     *
* (2)Place droop nose in 5° position.                 *
*    (Ref. 27-61-00, Adjustment/Test).                *
*    Position angle of attack sensor [66], ([67]) to  *
*    alpha i value of -15.34°. Select on pressure     *
*    generator Ps 692.29 mb (20.45 in.Hg) and Δp      *
*    288.55 mb (8.52 in.Hg). Check following values on*
*    instruments :                                    *
R *    - altimeter [19], ([20]) Hp 10170 ft ± 50 ft.    *
*    - airspeed indicator [21], ([22]) Vc 403 Kt ± 4Kt*
*    - machmeter [27], ([28]) M 0.723 ± 0.02          *
*    - angle of attack indicator [37], ([38]) alpha   *
*      2° ± 0.5°                                      *
* (3)Place droop nose in 12.5° position.              *
*    (Ref. 27-61-00, Adjustment/Test)                 *
*    Position angle of attack sensor [66], ([67]) to  *
*    alpha i value of -2.5°. Select on pressure gene- *
*    rator Ps 974.25 mb (28.77 in.Hg) and Δp 39.81 mb *
*    (1.18 in.Hg). Check following values on          *
*    instruments :                                    *
*    - altimeter [19], ([20]) Hp 1082 ft ± 30 ft      *
*    - airspeed indicator [21], ([22]) Vc 155.7 Kt ±  *
*      3 Kt.                                          *
*    - machmeter [27], ([28]) (minimum stop)          *
*    - angle of attack indicator [37], ([38]) alpha   *
*      15° ± 0.5°. IF                                 *
******************************************************
```

```
    ||     |         ----------------------------------------------
    OK     |-NOT OK-| Incorrect angle of attack value.            |
    ||     |        |          Ref. Chart 118.                    |
    ||     |         ----------------------------------------------
    ||     |         ----------------------------------------------
    ||     |        | One or more Hp, Vc or M values incorrect. Trip |
    ||     |-NOT OK-| circuit breaker [3], ([4]).                 |
    ||              | Replace ADC computer [5], ([6])             |
    ||               ----------------------------------------------
  ********************************************************
  * Unlock sensor error corrections.                     *
  * (1)With droop nose in 0° position, select on pressure*
  *    generators Ps 94.54 mb (2.8 in.Hg) and Δp 479.35mb*
  *    (14.16 in.Hg). Position angle of attack sensor    *
  *    [66] ([67]) to alpha i value of -5.61°. Check fol-*
  *    lowing values :                                   *
R *    - altimeter [19], ([20]) Hp 54410 ft ± 160 ft.    *
  *    - airspeed indicator [21], ([22]) Vc 486.7 Kt ±   *
  *      4 Kt                                            *
  *    - machmeter [27], ([28]) M 2.005 ± 0.02           *
  *    - angle of attack indicator [37], ([38]) alpha 2° *
  *      ± 0.5°.                                         *
  * (2)With droop nose in 5° position, select on pressure*
  *    generator Ps 692.29 mb (20.45 in.Hg) and Δp 288.55*
  *    mb (8.52 in.Hg). Position angle of attack sensor  *
  *    [66], ([67]) to alpha i value of -15.34°. Check   *
  *    following values :                                *
R *    - altimeter [19] ([20]) Hp 10050 ft ± 50 ft       *
  *    - airspeed indicator [21], ([22]) Vc 401 Kt ± 4 Kt*
  *    - machmeter [27], ([28]) M 0.717 ± 0.02           *
  *    - angle of attack indicator [37], ([38]) 2° ± 0.5°*
  * (3)With droop nose in 12.5° position select on       *
  *    pressure generator Ps 974.25 mb (28.77 in.Hg) and *
  *    Δp 39.81 mb (1.18 in.Hg). Position angle of attack*
  *    sensor [66], ([67]) to alpha i value of -2.5°.    *
  *    Check following values :                          *
R *    - altimeter [19], ([20]) Hp 1015 ft ± 30 ft       *
  *    - airspeed indicator [21], ([22]) Vc 150.6 Kt ± 3 *
  *      Kt.                                             *
  *    - machmeter [27], ([28]) (minimum stop)           *
  *    - angle of attack indicator [37] ([38]) alpha     *
  *      15° ± 0.5°. If                                  *
  ********************************************************
    ||     |         ------------------------------
    OK     |-NOT OK-| Trip circuit breaker [3], ([4])  |
    ||              | Replace ADC computer [5], ([6])  |
    ||               ------------------------------
  --------------------------------------------------------
  | ADC1 (ADC2) system is operational                    |
  --------------------------------------------------------
```

```
*************************************-------------------------------
* ILLUMINATION OF AMBER ADC WARNING  *| GROUND EQUIPMENT REQUIRED  |
* LIGHT AND SINGLE STROKE GONG. ILLU-*------------------------------
* MINATION OF AMBER ADC1 [1], (ADC2  *| DESCRIPTION       PART NO. |
* [2]) WARNING LIGHT.                *------------------------------
* FLAGS ON ALL INDICATORS.           *| MULTIMETER                 |
*************************************-------------------------------
*************************************
* Trip circuit breaker [3], ([4])    *
* Remove ADC computer [5], ([6])     *
* Reset preceding circuit breaker.   *
* Check following voltages :         *
* 28VDC between terminals 1F71 (2F71)*
* CA03 and CA04. 115VAC between ter- *
* minals 1F71 (2F71) AA03 and AA04.  *
*************************************
   ||     |       ----------------------------------------------------
   ||     |       |        (28VDC and 115VAC missing)                |
   ||     |       | Trip circuit breakers [3], [15], [23], [43]      |
R  ||     |       | [68], ([4], [16], [24], [46], [69]).             |
   YES    |-NO----| Remove SFC computer [7], ([8]). Replace relays   |
   ||     |       | [13], ([14]). Reset preceding circuit breakers.  |
   ||     |       | Check 28VDC and 115VAC.                          |
   ||     |       ----------------------------------------------------
   ||     |                           |
   ||     |                           NO
   ||     |                           |
   ||     |       ----------------------------------------------------
   ||     |       | Trip circuit breaker [9], ([10])                 |
   ||     |       | Replace ON/OFF switch [11], ([12])               |
   ||     |       ----------------------------------------------------
   ||     |       ----------------------------------------------------
   ||     |       |        (28VDC missing)                           |
   ||     |       | Trip circuit breakers [3], [15], [23], [43],     |
   ||     |-NO----| [68], ([4]), [16], [24], [46], [69]).            |
   ||     |       | Remove SFC computer [7], ([8]).                  |
   ||     |       | Replace ADC power switching relay [13], [14]).   |
   ||     |       ----------------------------------------------------
   ||     |       ****************************************************
   ||     |       *        (115VAC missing)                          *
   ||     |-NO----* Check 115VAC at circuit breaker [15], ([16])     *
   ||             * output.                                          *
   ||             ****************************************************
   ||                 |                                 |
   ||                YES                                NO
   ||                 |                                 |
```

Chart 101 (Sheet 1 of 2)

```
 ||     -------------------------------------  -------------------------
 ||     | Trip circuit breakers [3], [15],  |  | Replace circuit       |
 ||     | [23], [43], [68], ([4], [16],     |  | breaker [15],         |
 ||     | [24] [46], [69]).                 |  | ([16]).               |
 ||     | Remove SFC computer [7], ([8])    |  -------------------------
 ||     | Replace ADC power switching relay|
 ||     | [13], ([14]).                     |
 ||     =====================================
*************************************************
* Trip circuit breaker [3], ([4]).              *
* Check continuity between terminals 1F71 (2F71) *
* BA16 and BA17 while holding ADC1 [1] (ADC2 [2]) *
* warning light pressed.                        *
*************************************************
            |                      |
           YES                     NO
            |                      |
-------------------------  -------------------------
| Replace ADC computer  |  | Replace ADC1 [1],     |
R | [5], ([6]).         |  | (ADC2 [2]) warning    |
-------------------------  | light                 |
                           -------------------------
```

Chart 101 (Sheet 2 of 2)

```
*********************************
* FLAGS ON ALL INDICATORS EXCEPT*
* VERTICAL SPEED INDICATOR [17],*
* ([18]).                       *
*********************************

         *********************************************
         * Check on altimeter [19], ([20]) and airspeed*
         * indicator [21], ([22]) that mode indicator  *
         * indicates ADC.                              *
         *********************************************
                      |                       |
                     YES                      NO
                      |                       |
-------------------------------------  ------------------------------
| Trip circuit breakers [3], [15],  |  | Replace circuit breaker    |
| [23], [43], [68], ([4]), [16],    |  | [23], ([24]).              |
| [24, [46], [69]).                 |  ------------------------------
| Remove SFC computer [7], ([8]).   |
| Replace ADC power switching relay |
| [13], ([14]).                     |
-------------------------------------
```

Chart 102

```
***********************************
* INCORRECT COMPARISON WARNING PRO-*
* DUCING : ILLUMINATION OF RED ADS *
* WARNING LIGHT ON MASTER WARNING  *
* PANEL AND SOUNDING OF REPEATER   *
* GONG.                            *
***********************************
****************************************
* Trip circuit breakers [3], [15], [23] *
* [43], [68].                           *
* Remove SFC computer [7].              *
* Replace ADC power switching relay [13]*
* Reset preceding circuit breakers.     *
* Check that incorrect comparison warn- *
* ing is cancelled.                     *
****************************************
                 |
                 |        ---------------------------------------
                 |        | Trip circuit breakers [4], [16],    |
                 |        | [24], [46], [69].                   |
                 |        | Remove SFC computer [8].            |
                 |-NO-----| Replace ADC power switching relay   |
                          | [14].                               |
                          | Reset preceding circuit breakers.   |
                          | Check that warning is cancelled.    |
                          ---------------------------------------
```

Chart 103

```
****************************************
* FLAG ON ONE INDICATOR ONLY ON CAPTAIN*
* (FIRST OFFICER) INSTRUMENT PANEL     *
* EXCEPT VERTICAL SPEED INDICATOR [17],*
* ([18]).                              *
****************************************

****************************************
* Replace defective indicator.         *
* (Ref. 34-00-00, Removal/Installation)*
* Check that flag has disappeared.     *
****************************************
                    |
                    |
                    |         -------------------------------------
                    |-NO----| Trip circuit breaker [3], ([4]).|
                            | Replace ADC computer [5], ([6]).|
                              -------------------------------------
```

Chart 104

```
***************************************-----------------------------
* FLAG ON VERTICAL SPEED INDICATOR    *| GROUND EQUIPMENT REQUIRED  |
* [17].                               *-----------------------------
***************************************| DESCRIPTION       PART NO. |
                                       -----------------------------
                                       | MULTIMETER                 |
                                       -----------------------------

*******************************************************************
* Reset circuit breakers [39] and [40] for the ground proximity war*
* ning system W633, [41] and [42] for the radio altimeter 1S51. On *
* panel 2-211, on radio altimeter indicator 1S53 turn knob marked  *
* with triangle in clockwise direction to cancel black OFF flag    *
* mask. Press red TERRAIN warning light W636 on panel 2-211, or    *
* W637 on panel 2-212 for approximately 5 seconds. Aural warning   *
* sounds twice : WHOOP WHOOP plus PULL UP and the two TERRAIN war- *
* ning lights flash. On releasing the warning light, the aural war-*
* ning sounds once and ceases and the warning lights extinguish.   *
*******************************************************************
   |             |       **************************************
  YES            |-NO-------* Check 26VAC at circuit breaker [43]  *
   |                     * output.                             *
   |                     **************************************
   |                       |                |
   |                      YES               NO
   |                       |                |
   |  ------------------------------------  ---------------------------
   |  | Trip circuit breakers [3], [15]  |  | Replace circuit breaker|
   |  | [23], [43], [68].                |  | [43].                  |
   |  | Remove SFC computer [7]. Replace |  ---------------------------
   |  | ADC power switching relay [13].  |
   |  ------------------------------------
*******************************************************************
* Place ADC1 start up switch [11] in OFF position. Trip circuit    *
* breaker APFD [44]. Replace VSI amplifier [45]. Place switch [11] *
* in ON position. Reset circuit breaker [44]. Check that flag has  *
* disappeared.                                                     *
*******************************************************************
   |     *************************************************************
   |     * Place switch [11] in OFF position. Trip circuit breaker  *
   |-NO-* APFD [44]. Replace vertical speed indicator [17]. Place  *
         * switch [11] in ON position. Reset circuit breaker [44].  *
         * Check that flag has disappeared.                         *
         *************************************************************
                             |
                             |      ----------------------------
                             |-NO---| Trip circuit breaker [3].|
                                    | Replace ADC computer [5].|
                                    ----------------------------
```

Chart 105

```
***************************************-------------------------------
* FLAG ON VERTICAL SPEED INDICATOR    *| GROUND EQUIPMENT REQUIRED   |
* ([18]).                             *-------------------------------
***************************************| DESCRIPTION       PART NO.  |
                                       -------------------------------
                                       | MULTIMETER                  |
                                       -------------------------------

             ************************************************
             * Check 26VAC at circuit breaker ([46]) output.*
             ************************************************
                  |                                      |
                26VAC                                    0V
                  |                                      |
  ******************************************  ---------------------------
R * Trip circuit breakers ([4], [16], [24]*  | Replace circuit breaker|
R * [46], [69]).                          *  | ([46]).                |
  * Remove SFC computer ([8]). Replace ADC*  ---------------------------
  * power switching relay ([14]).         *
  * Install computer ([8]) and reset pre- *
  * ceding circuit breakers.              *
  * Check that flag has disappeared.      *
  ******************************************
     |      ********************************************************
     |      * Place ADC2 ON/OFF switch ([12]) in OFF position. Trip *
     |-NO---* circuit breaker APFD ([47]). Replace VSI amplifier    *
            * ([48]). Place switch ([12]) in ON position.           *
            * Reset circuit breaker ([47]). Check that flag has     *
            * disappeared.                                          *
            ********************************************************
                                 |
                                 NO
                                 |
            ********************************************************
            * Place switch ([12]) in OFF position. Trip circuit     *
            * breaker ([47]). Replace vertical speed indicator      *
            * ([18]). Place switch ([12]) in ON position. Reset     *
R           * circuit breaker ([47]). Check that flag has           *
            * disappeared.                                          *
            ********************************************************
                                 |
                                 NO
                                 |
R                     -----------------------------
R                     | Trip circuit breaker ([4]).|
R                     | Replace ADC computer ([6]).|
R                     -----------------------------
```

Chart 106

```
**************************************
* OVERSPEED WARNING : ACTIVATION OF  *
* WARBLE AURAL WARNING.              *
**************************************

*********************************************************
* Place switch ([12]) or [11] in case of channel 2 in ON*
* position.                                             *
* Read total temperature information on indicators [25],*
* [26], [49].                                           *
* Total temperature is less than 131°C and identical on *
* the 3 indicators.                                     *
*********************************************************
          |           |
          |           |     --------------------------------------
          |           |     | Total temperature is greater than  |
R         YES         |-NO----| 131°C or at maximum stop 200°C on  |
          |                 | indicators [25], ([26]).           |
          |                 --------------------------------------
          |                                  |
          |                                 YES
          |                                  |
----------------------      -----------------------------------------
| Trip circuit breaker|     | Replace total temperature sensor [50],|
| [3], ([4]).         |     | ([51]).                               |
| Replace ADC computer|     -----------------------------------------
| [5], ([6]).         |
----------------------
```

Chart 107

```
***************************************-------------------------------
* TEST DOES NOT OPERATE.               *| GROUND EQUIPMENT REQUIRED  |
***************************************-------------------------------
                                        | DESCRIPTION       PART NO. |
                                        ------------------------------
                                        | MULTIMETER                 |
                                        ------------------------------

   *********************************************
   * Place test selector [52], ([53]) in TEST  *
   * 1 position. Indicator pointers deviate.   *
   *********************************************
           |                                 |
           NO                               YES
           |                                 |
************************************ ******************************
* On computer front panel [5], ([6])* * On computer front panel [5]*
* press TEST 1 push button. Indi-   * * ([6]) press TEST 3 push    *
* cator pointers deviate.           * * button. If test is correct *
************************************ * MONIT indicator light illu-*
         |             |              * minates.                   *
         |             |              ******************************
         |             |                    |            |
R        NO            YES------------------YES          NO
         |                            |                  |
         |                            |   ---------------------------
         |                            |   | Trip circuit breaker [3]|
         |                            |   | ([4]). Replace ADC com- |
         |                            |   | puter [5], ([6]).       |
         |                            |   ---------------------------
         |                            |
R ************************************ ********************************
* Trip circuit breaker (3), ([4]). * * Trip circuit breaker [3],    *
* Remove ADC computer [5], ([6]).  * * ([4]). Remove ADC computer   *
* Check continuity between termi-  * * [5], ([6]). Place test se-   *
* nals 1F71 (2F71) CA15 and BA31.  * * lector switch [52], ([53])   *
************************************ * in MON position and check    *
         |             |              * continuity between terminals*
         |             |              * 1F71 (2F71) BA30 and BA31.   *
         |             |              ********************************
         |             |                    |             |
         NO            YES                  NO            YES
         |             |                    |             |
```

Chart 108 (Sheet 1 of 2)

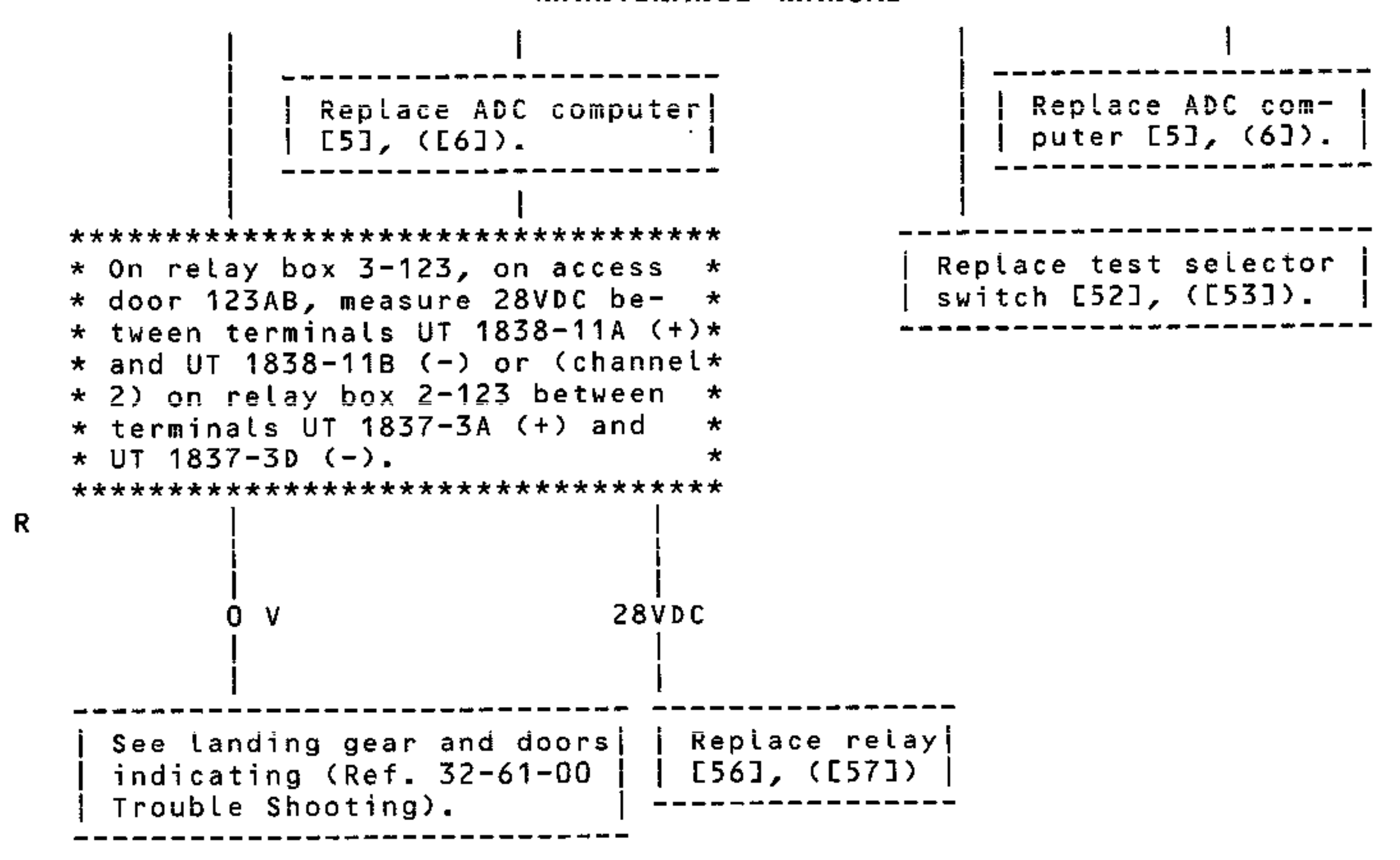


Chart 108 (Sheet 2 of 2)

```
*****************************
* INCORRECT GENERAL WARNING *
*****************************

**************************************
* ADC1 [1], (ADC2 [2]) warning light *
* is illuminated on ADC control panel*
**************************************
                 |      |
                 |      |
                 |      |  ------------------------------------------
                 |      |  | No single-stroke gong or illumination of|
                NO      |-YES| amber ADC warning light on master war-  |
                 |         | ning panel.                             |
                 |         |            See MASTER WARNING.          |
                 |         |     (Ref. 33-15-00, Trouble Shooting).  |
                 |         ------------------------------------------
                 |
                 |
                 |
******************************************************************
* Place test selector switch [52], ([53]) in NORM position. Carry  *
* out RESET by pressing ADC1 [1] (ADC2 [2]) warning light. Check   *
* that circuit breakers required for TRIM 1 (TRIM 2) operation are *
* reset, (Ref. 22-23-00, Adjustment/Test). On panel 9-211 place    *
* pitch trim handwheel in 0° position and the four throttles in id-*
* le position. Engage ELECTRIC TRIM 1 (2) switch on panel 4-211.   *
* Check that switch remains engaged. Place test selector switch    *
* [52] ([53]) in MON position. ELECTRIC TRIM 1 (2) switch falls to *
* OFF position.                                                    *
******************************************************************
                 |                                       |
                NO                                      YES
                 |                                       |
---------------------------  -----------------------------------------
| Trip circuit breaker [3],| | Trip circuit breakers [3], [9],       |
| ([4]). Replace ADC compu-| | ([4], [10]). Replace ON/OFF switch    |
| ter [5], ([6]).          | | [11], ([12]).                         |
---------------------------  -----------------------------------------
```

Chart 109

R * TEST DOES NOT OPERATE. *

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

* On computer front panel [5], ([6]) press TEST 1 push button. If test is correct the 4 check indicator lights illuminate.

YES

-NO- | Trip circuit breaker [3], ([4]). Replace ADC computer [5], ([6]).

* Position test selector switch [52], ([53]) in TEST 1 position.
* Trip circuit breaker [3], ([4]).
* Remove ADC computer [5], ([6]).
* Check continuity between terminals 1F71 (2F71) BA31 and BB43.

YES | Replace ADC computer [5], ([6]).

NO | Replace test selector switch [52], ([53]).

Chart 110

```
**********************************
* BLUE TEST INDICATOR LIGHT [54], *
* ([55]) IS ILLUMINATED, A FLAG OR*
* INCORRECT INFORMATION APPEARS ON*
* AN INDICATOR.                   *
**********************************


****************************************
* Replace indicator.                   *
* (Ref. 34-00-00, Removal/Installation).*
* Check that flag has disappeared.     *
****************************************
              |
              |
              |                  ----------------------------------
              |-NO----------| Trip circuit breaker [3], ([4]).|
                            | Replace ADC computer [5], ([6]).|
                             ----------------------------------
```

Chart 111

R * TEST DOES NOT OPERATE. *

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

* On computer front panel [5], ([6]) press TEST 2 push button. If test is correct the 4 check indicator lights illuminate.

YES → (continue below)

NO → Trip circuit breaker [3], ([4]). Replace ADC computer [5], ([6]).

Place test selector switch [52], ([53]) in TEST 2 position.
Trip circuit breaker [3], ([4]).
Remove ADC computer [5], ([6]).
Check continuity between terminals 1F71 (2F71) BA31 and BB44.

YES → Replace ADC computer [5], ([6]).

NO → Replace test selector switch [52], ([53]).

Chart 112

```
****************************************-------------------------------
* BLUE TEST INDICATOR LIGHT [54],      *| GROUND EQUIPMENT REQUIRED   |
* ([55]) DOES NOT ILLUMINATE.          *-------------------------------
****************************************| DESCRIPTION       PART NO. |
                                        -------------------------------
                                        | MULTIMETER                  |
                                        -------------------------------


************************************
* On ADC computer front panel [5],*
* ([6]) check indicator lights Hp,*
* M, Vc and I are illuminated.    *
************************************
                |        |
                |        |        ----------------------------------
               YES       |-NO-----| Trip circuit breaker [3], ([4])|
                |                 | Replace ADC computer [5], ([6])|
                |                 ----------------------------------
                |
*******************************************
* Trip circuit breaker [3], ([4]). Remove *
* ADC computer [5], ([6]). Check continuity*
* between terminals 1F71 (2F71) BA61 and  *
* CA60.                                   *
*******************************************
    |   |
    |   |   ********************************************************
    |   |   * On relay box 2-123, on access door 123AB, measure    *
   YES  |-NO-* 28 VDC between terminals UT 1837-7D (-) and UT      *
    |       * 1837-7C (+) or (channel 2) on relay box 3-123        *
    |       * between terminals UT 1838-14D (+) and UT 1838-14C    *
    |       * (-).                                                 *
    |       ********************************************************
R   |                           |                     |
    |                           |                     |
    |                           |                     |
************************************                  |
* Check continuity between termi-* |                  |
* nals 1F71 (2F71) BA61 and AB36.* |                  |
************************************                  |
    |            |              |                     |
   YES           NO           28VDC                  0 V
    |            |              |                     |
--------------   |     -----------------    ---------------------------
| Replace ADC|   |     | Replace visor  |   | See visor and droop     |
R | computer |   |     | relay [58],    |   | nose system :           |
R | [5], ([6]).| |     | ([59]).        |   | (Ref. 27-61-00,         |
--------------   |     -----------------    | Trouble Shooting).      |
                 |                          ---------------------------
```

Chart 113 (Sheet 1 of 2)

```
**********************************************************
* Trip circuit breakers required for operation of nose   *
* position transmitter [60]. (Ref. 27-61-51, Adjustment/ *
* Test). On [60] on access door 113DB/121AB, disconnect  *
* cable and check continuity between terminals M58A-E    *
* and M58A-Z. For channel 2 between M58B-E and M58B-Z.   *
**********************************************************
               |                            |
               |                            |
              YES                           NO
               |                            |
               |                            |
-----------------------------  ------------------------------------
| Ref. WDM circuit, 34-11-05|  | Replace nose position transmitter|
-----------------------------  | [60].                            |
                               ------------------------------------
```

Chart 113 (Sheet 2 of 2)

```
***************************************-------------------------------
* OVERSPEED WARNING (WARBLE) DOES     *| GROUND EQUIPMENT REQUIRED  |
* NOT OPERATE.                        *-------------------------------
***************************************| DESCRIPTION      PART NO. |
                                       -------------------------------
                                       | MULTIMETER                 |
                                       -------------------------------


*********************************************************
* Trip circuit breaker [3], ([4]). Remove ADC computer [5],  *
* ([6]). Place ADC ON/OFF switch [11], ([12]) in ON position.*
* Overspeed warning operates.                           *
*********************************************************
        |   |    *********************************************
        |   |    * Remove AUDIO WARNING [61]. Measure 28VDC between*
       YES  |-NO-* terminals W381-AB9 and AB26, for channel 2     *
        |        * between W381-AA9 and AA26.                     *
        |        *********************************************
        |                             |               |
        |                            0 V            28VDC
        |                             |               |
*************************** ********************** ------------
* Measure 28VDC between ter-* * Trip circuit breakers* | Replace   |
* minals 1F71 (2F71) BB48   * * [62], ([63]). Remove * | AUDIO WAR-|
* and CA04.                 * * DOOR WARN relay box  * | NING [61].|
*************************** * [64]. Check 28VDC    * ------------
        |       |           * between terminal     *
       0 V    28VDC         * W320-AA48 (AA50) and *
        |       |           * aircraft ground.     *
        |       |           **********************
        |       |                |          |
----------      |                |          |
| Ref. WDM|     |                |          |
| circuit |     |              28VDC       0 V
| 34-11-05|     |                |          |
----------      |                |          |-----------
                |                |                     |
      ------------- ------------------------   ------------
      | Replace ADC | | Replace relay R25 (R24)|  | Replace    |
      | computer [5]| | on DOOR WARN relay box |  | circuit    |
      | [6].        | | [64]                   |  | breaker    |
R     -------------  ------------------------   | [62],      |
                                                | ([63]).    |
                                                ------------
```

Chart 114

```
*************************************------------------------------
* TEST DOES NOT OPERATE             *| GROUND EQUIPMENT REQUIRED  |
*************************************------------------------------
                                     | DESCRIPTION       PART NO. |
                                     ------------------------------
                                     | MULTIMETER                 |
                                     ------------------------------

*************************************
* Place test selector switch [52]   *
* ([53]) in COMP position. Trip     *
* circuit breaker [3], ([4]). Remove*
* ADC computer [5], ([6]). Check    *
* continuity between terminals 1F71 *
* (2F71) CA15 and BB57.             *
*************************************
            |              |
           YES             NO
            |              |
  ----------------------- -----------------------
  | Replace ADC computer| | Replace test selector|
  | [5], ([6]).         | | switch [52], ([53]). |
  ----------------------- -----------------------
```

Chart 115

```
***********************************
* BLUE TEST INDICATOR LIGHT [54],*
* ([55]) DOES NOT ILLUMINATE.    *
***********************************


***************************************************
* Trip circuit breaker [3], ([4]). Replace ADC    *
* computer [5], ([6]). Reset preceding circuit    *
* breaker. Place test selector switch [52] ([53]) *
* in COMP position.                               *
* TEST indicator light [54], ([55]) illuminates.  *
***************************************************
                   |
                   |         ----------------------------------------
                   |-NO------| Trip circuit breaker [4], ([3]).        |
                             | Replace ADC2 computer [6] (ADC1 [5])    |
                             | by original ADC1 (ADC2) computer.       |
                             ----------------------------------------
```

Chart 116

NO ACTIVATION OF MAIN COMPARATOR WARNING

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

R Remove MASTER WARNING [65]. Measure 28VDC between terminal W271 A-6A 21 and aircraft ground.

- 28VDC: Trip circuit breaker [4]. Replace ADC computer [6].
- 0 V: No repeater gong warning or illumination of red ADS warning light on master warning panel. Ref. MASTER WARNING. (Ref. 33-15-00, Trouble Shooting).

Chart 117

```
***********************************
* INCORRECT ANGLE OF ATTACK VALUE *
***********************************


              **********************************************
              * Replace angle of attack sensor [66], ([67])*
              * Repeat preceding tests and check alpha     *
              * values on angle of attack indicator [37],  *
              * ([38]).                                    *
              **********************************************
                                    |
                                    NO
                                    |
              **********************************************
              * Replace nose position transmitter [60].    *
              * Repeat preceding tests and check alpha     *
              * values on angle of attack indicator [37],  *
              * ([38]).                                    *
              **********************************************
                                    |
                                    NO
                                    |
              ----------------------------------------------
              | Trip circuit breaker [3], ([4]).           |
              | Replace ADC computer [5], ([6]).           |
              ----------------------------------------------
```

Chart 118

R **ON A/C 001-005,

NO MACH INDICATION ON THE TWO CABIN MACHMETERS

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

Check 28VDC at output of circuit breaker [34].

- 0V → Check 28VDC at input of circuit breaker
  - 0V → Ref. WDM 24-52-12 DIST
  - 28VDC → Trip and replace circuit breaker [34].
- 28VDC → (go to next step)

Check 115VAC at output of circuit breaker [35]

- 115VAC → (go to next step)
- 0V → Check 115VAC at input of circuit breaker
  - 115VAC → Trip and replace circuit breaker [35].
  - 0V → Ref. WDM 24-51-31 DIST

Trip circuit breakers [34], [35]. On ADC control panel (9-211) place ADC2 ON/OFF switch in OFF position. Remove one of the cabin machmeters [31], [32]. Reset circuit breakers. According to machmeter removed measure :
R -28VDC on connector 6F80-A (4F80-A) between terminals C(+) and D(-).
- 115VAC on connector 6F80-A (4F80-A) between terminals A and B.

- YES → Replace one of the machmeters [31] or [32].
  - YES → Replace machmeter [31] or [32]
  - NO → Trip circuit breaker ([4]). Replace ADC computer ([6]).
- NO → Trip circuit breakers [34] [35]. Replace CABIN MACH IND ON/OFF switch [35].

Chart 119

R **ON A/C 006-007,

NO MACH INDICATION ON THE TWO CABIN MACHMETERS

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

Check 28VDC at output of circuit breaker [34].

- 0V → Check 28VDC at input of circuit breaker
  - 0V → Ref. WDM 24-52-12 DIST
  - 28VDC → Trip and replace circuit breaker [34].
- 28VDC → (to next step below)

Check 115VAC at output of circuit breaker [35]

- 115VAC → (to next step below)
- 0V → Check 115VAC at input of circuit breaker
  - 115VAC → Trip and replace circuit breaker [35].
  - 0V → Ref. WDM 24-51-31 DIST

Trip circuit breakers [34], [35]. On ADC control panel (9-211) place ADC2 ON/OFF switch in OFF position. Remove one of the cabin machmeters [31], [32]. Reset circuit breakers. According to machmeter removed measure :
-28VDC on connector F115-A (F116-A) between terminals C(+) and D(-).
- 115VAC on connector F115-A (F116-A) between terminals A and B.

- YES → Replace one of the machmeters [31] or [32].
  - YES → Replace machmeter [31] or [32]
  - NO → Trip circuit breaker ([4]). Replace ADC computer ([6]).
- NO → Trip circuit breakers [34] [35]. Replace CABIN MACH IND ON/OFF switch [35].

Chart 119

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] ADC1 warning light		9-211	1F95	ADC control panel	34-11-29 R/I	34-11-05
[2] ADC2 warning light		9-211	2F95	ADC control panel	34-11-29 R/I	34-11-05
[3] Circuit breaker		1-213	1F74	Map Ref. P 12	24-50-00 R/I	34-10-01
[4] Circuit breaker		5-213	2F74	Map Ref. F 12	24-50-00 R/I	34-10-01
[5] Air Data computer 1	215BS	6-215	1F71	LH electronics rack	34-00-00 R/I	34-10-00
[6] Air data computer 2	216BS	6-216	2F71	RH electronics rack	34-00-00 R/I	34-10-00
[7] SFC computer 1	215BS	6-215	1C650	LH electronics rack	27-39-11 R/I	27-00-00
[8] SFC computer 2	216BS	6-216	2C650	RH electronics racks	27-39-11 R/I	27-00-00
[9] Circuit breaker		1-213	1H2	Map Ref. K 9	24-25-00 R/I	30-31-02
[10] Circuit breaker		3-213	2H2	Map Ref. A 12	24-25-00 R/I	30-31-02
[11] ON/OFF switch		9-211	1F94	ADC control panel	34-11-29 R/I	34-10-01
[12] ON/OFF switch		9-211	2F94	ADC control panel	34-11-29 R/I	34-10-01
[13] ADC power switching relay	215BS	6-215	1F93	LH electronics rack		34-10-01

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[14] ADC power switching relay	216BS	6-216	2F93	RH electronics rack		34-10-01
[15] Circuit breaker		2-213	1F73	Map Ref. F 3	24-50-00 R/I	34-10-01
[16] Circuit breaker		13-216	2F73	Map Ref. F 15	24-50-00 R/I	34-10-01
[17] Vertical speed indicator		2-211	1F85	Captain instrument panel	34-11-16 R/I	34-11-01
[18] Vertical speed indicator		2-212	2F85	First Officer instrument panel	34-11-16 R/I	34-11-06
[19] Altimeter		2-211	1F79	Captain instrument panel	34-11-13 R/I	34-11-01
[20] Altimeter		2-212	2F79	First Officer instrument panel	34-11-13 R/I	34-11-06
[21] Airspeed indicator		2-211	1F81	Captain instrument panel	34-11-15 R/I	34-11-02
[22] Airspeed indicator		2-212	2F81	First Officer instrument panel	34-11-15 R/I	34-11-07
[23] Circuit breaker		2-213	1F75	Map Ref. B 3	24-50-00 R/I	34-10-01
[24] Circuit breaker		13-216	2F75	Map Ref. A 14	24-50-00 R/I	34-10-01

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[25] Temperature indicator		2-211	1F82	Captain instrument panel	34-11-11 R/I	34-11-03
[26] Temperature indicator		2-212	2F82	First Officer instrument panel	34-11-11 R/I	34-11-08
[27] Machmeter		2-211	1F80	Captain instrument panel	34-11-14 R/I	34-11-04
[28] Machmeter		2-212	2F80	First Officer instrument panel	34-11-14 R/I	34-11-09
[29] Digital machmeter		4-214	3F80	Flight Engineer panel	34-11-23 R/I	34-11-04
**ON A/C ALL						
[30] Not applicable						
R **ON A/C 001-005,						
[31] Mach Indicator		Zone 221 Galley No.4	6F80	Galley No. 4 partition	34-11-27 R/I	34-11-09
[32] Mach Indicator		Zone 224 Centre Amenities Unit	4F80	Centre Amenities Unit partition	34-11-27 R/I	34-11-09
[33] CABIN MACH INDICATORS ON/OFF switch		1-221	3F94	Forward LH steward station		34-11-09

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
[34] Circuit breaker		15-216	3F74	Map. Ref. A 20	24-50-00 R/I	34-11-09
[35] Circuit breaker		13-216	3F73	Map. Ref. C 18	24-50-00 R/I	34-11-09
R **ON A/C 006-007,						
[31] Mach indicator		Zone 221 Galley No.4	F115	Galley No.4 Partition	34-11-27 R/I	34-11-09
[32] Mach indicator		Zone 224 Centre Ameni-ties Unit	F116	Centre Amenities Unit partition	34-11-27 R/I	34-11-09
[33] CABIN MACH INDICATORS ON/OFF switch		1-221	3F94	Forward LH steward station	34-11-09	
[34] Circuit breaker 28VDC		15-216	F117	Map. Ref. A20	24-50-00 R/I	34-11-09
[35] Circuit breaker 115VAC		13-216	F118	Map. Ref. C18	24-50-00 R/I	34-11-09
**ON A/C ALL						
[36] Digital altimeter		4-214	3F79	Flight Engineer panel	34-11-24 R/I	34-11-06
[37] Angle of attack indicator		2-211	1F83	Captain instrument panel	34-11-12 R/I	34-11-03

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[38] Angle of attack indicator		2-212	2F83	First Officer instrument panel	34-11-12 R/I	34-11-08
[39] Circuit breaker		13-215	W631	Map Ref. G 4	24-50-00 R/I	34-47-11
[40] Circuit breaker		15-215	W632	Map Ref. G 7	24-50-00 R/I	34-47-11
[41] Circuit breaker		2-213	1S56	Map Ref. D 8	24-50-00 R/I	34-42-01
[42] Circuit breaker		15-215	S57	Map Ref. C 5	24-50-00 R/I	34-42-01
[43] Circuit breaker		2-213	1F97	Map Ref. A 3	24-50-00 R/I	34-11-01
[44] Circuit breaker		1-213	1C17	Map Ref. Q 13	24-50-00 R/I	34-11-01
[45] VSI amplifier	215GS	1-215	1F96	LH elec-tronics rack	34-11-17 R/I	34-11-01
[46] Circuit breaker		13-216	2F97	Map Ref. B 13	24-50-00 R/I	34-11-06
[47] Circuit breaker		5-213	2C17	Map Ref. A 11	24-50-00 R/I	34-11-06
[48] VSI amplifier	216GS	1-216	2F96	RH elec-tronics rack	34-11-17 R/I	34-11-06
[49] Tempera-ture indicator		4-214	3F82	Flight Engineer panel	34-11-22 R/I	34-11-08
[50] Total temperature sensor	access door 113BB	Zone 113	1F98	Droop nose	34-11-32 R/I	34-11-03

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[51] Total temperature sensor	access door 113BB	Zone 114	2F98	Droop nose	34-11-32 R/I	34-11-08
[52] Test selector switch		9-211	1F102	ADC control panel	34-11-29 R/I	34-11-02
[53] Test selector switch		9-211	2F102	ADC control panel	34-11-29 R/I	34-11-07
[54] Test indicator light		9-211	1F89	ADC control panel	34-11-29 R/I	34-11-02
[55] Test indicator light		9-211	2F89	ADC control panel	34-11-29 R/I	34-11-07
[56] Relay	access door 123AB	3-123	G310	RH hy- draulic relays box	32-00-00 R/I	34-11-02
[57] Relay	access door 123AB	2-123	G300	LH hy- draulic relays box	32-00-00 R/I	34-11-07
[58] Visor up relay	access door 123AB	2-123	M18	LH hy- draulic relays box	27-61-00 R/I	34-11-05
[59] Visor up relay	access door 123AB	3-123	M20	RH hy- draulic relays box	27-61-00 R/I	34-11-05
[60] Nose posi- tion trans- mitter	access door 113DB/ 121AB	121	M58		27-61-51 R/I	34-11-05
[61] Audio warning	216DC	7-216	W381	RH elec- tronics rack	31-23-11 R/I	34-11-05

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[62] Circuit breaker		1-123	W374	Map Ref. S 19	24-50-00 R/I	34-11-05
[63] Circuit breaker		5-213	W373	Map Ref. C 18	24-50-00 R/I	34-11-05
[64] Door warn relay box	216DS	7-216	W320	RH elec- tronics rack	52-71-00 R/I	34-11-05
[65] Master warning control unit	216DS	7-216	W253	RH elec- tronics rack	33-15-11 R/I	34-11-05
[66] Angle of attack sensor	access door 113BB	Zone 113	1F91	Droop nose	34-11-31 R/I	34-11-03
[67] Angle of attack sensor	access door 113BB	Zone 114	2F91	Droop nose	34-11-31 R/I	34-11-08
[68] Circuit breaker		2-213	1F78	Map Ref. A 2	24-50-00 R/I	34-10-01
[69] Circuit breaker		13-216	2F78	Map Ref. F 14	24-50-00 R/I	34-00-01

Component Identification
Table 101

R

NORMAL AIR DATA INSTRUMENTATION MAINTENANCE PRACTICES

1. General

A. Electrical de-icing.

The pitot/static nose probe, fuselage mounted pitot probes and static vents, are electrically heated for de-icing purposes.
If they are switched on when the aircraft is on the ground they get HOT. (The pitot probes can generate tip temperatures of up to 500°c under no airflow conditions).
Before any maintenance work is carried out in the immediate vicinity of these probes and vents it must be checked that the relevant probe or sensor heating supply is switched off, and a "DO NOT OPERATE" sign is placed on the relevant heater control switch.
Ground operation of the heaters should be kept to a minimum.
Heaters should only be operated on the ground during Maintenance, when checking the function of the current sense relays, and correct operation of the heating circuits.
Pitot/static nose probe, pitot probe and static vent heaters MUST NOT be switched on under any circumstances when leak testing adaptors, protective covers or blanks are fitted.

2. Leak Checks

A. Leak checks must be carried out when :-

(1) Any connection in the STANDBY pitot/static system is disturbed e.g. Pitot/Static Nose Probe, Altimeter,
R Airspeed Indicator, Combined Speed Indicator, and No.2 "Air Intake Sensor Unit".

(2) If more than one pitot and one static quick release connection are disturbed in one main system e.g. No.2 ADC and No.3 or No.4 Air Intake Sensor Unit.

(3) If any quick release connections in both main pitot/static systems are disturbed, both systems must be leak checked e.g. interchange of ADC's or Air Intake Sensor Units.

(4) If any pitot/static connections, other than the quick release type are disturbed in any pitot/static system e.g. Pitot Heads, Static Vents and Drain Taps.

No leak check is required if only one pitot and one static quick release connections on only one system are disturbed e.g. a single ADC change or a single Air Intake Sensor Unit change.

3. Pressure Corrections

A. The sensed static pressures between ADCI and ADC2 are different, and are different for each aircraft. Loads have been added by placing resistors in applicable diode/ resistor assemblies and installing modified ADC's in the aircraft.

B. Only two types of ADC's are employed on the aircraft. These are fully interchangeable except that 038 (unmodified) units will not activate the load circuit added to post CM42296 aircraft. The 039 (modified) units will function normally if fitted to pre CM 42296 aircraft as the additional load circuit will not exist.

C. The aircraft diode/resistor assemblies MUST NOT be interchanged between aircraft and ADCI/ADC 2 systems, unless the assembly is reworked to the individual aircraft system
R characteristics. (See table 201 for ADC1 and table 202
R for ADC2).

NOTE : Corrections are for Mach 2.0 regime.

CORRECTION APPLIED TO ADC1

B.A. AIRCRAFT	ADC 1			
	MACH CORRECTION Δ M	ALTITUDE CORRECTION Δ Z	W515	
			RESISTANCE IN OHMS	TERMINALS
G-N81AC(204)	- 0.005	- 125 ft	8.2 K	T & S
R G.BOAA G-N94AA(206)	+ 0.010	+ 250 ft	470	T & N
R G.BOAB G-N94AB(208)	0	0	-	-
R G.BOAD G-N94AD(210)	+ 0.005	+ 125 ft	6.8 K	T & N
R G.BOAE G-N94AE(212)	+ 0.010	+ 250 ft	470	T & N
R G.BOAG R (214)	+ 0.010	+ 250 ft	470	T & N
R G.BOAF R (216)	0	0	-	-

PRESSURE CORRECTIONS
Table 201

CORRECTION APPLIED TO ADC2

	B.A. AIRCRAFT	ADC 2			
R		MACH CORRECTION Δ M	ALTITUDE CORRECTION Δ Z	W525	
				RESISTANCE IN OHMS	TERMINALS
R	G-N81AC(204)	- 0.015	- 350 ft	1.8 K	J & G
R	G.BOAA G-N94AA(206)	0	0	-	-
R	G.BOAB G-N94AB(208)	- 0.025	- 575 ft	470	J & G
R	G.BOAD G-N94AD(210)	- 0.005	- 135 ft	8.2 K	J & G
R	G.BOAE G-N94AE(212)	- 0.010	- 250 ft	3.6 K	J & G
R R	G.BOAG (214)	0	0	-	-
R R	G.BOAF (216)	- 0.010	- 250 ft	3.6 K	J & G

PRESSURE CORRECTIONS
R Table 202



RB 4. Pitot/Static Flexible Hose

RB A. Replacement of the Outersleeve.

RB (1) If the black outer protective sleeve is found to be
RB damaged; note the original length and position of this
RB sleeve then remove the whole sleeve.

RB (2) Inspect the pitot or static hose for damage.

RB NOTE: Discard the hose if the protective metal braid
RB is damaged.

RB CAUTION: USE THE MINIMUM POSSIBLE HEAT GUN SETTING
RB WHEN HEAT SHRINKING SLEEVE ONTO A HOSE.

RB (3) Resleeve the hose using a single length of 135°
RB semiflex Heatshrink sleeve (Part number 2G198-3-
RB 11B09-BLK). The final length and position of sleeve to
RB be the same as noted in para.(1).

RB (4) Leak check hose (Ref.34-10-00 Maintenance Practices).

1. General

Analysis of calibrations of generated parameters shows a systematic difference, always in the same sense and increasing with mach number, between ADC1 and ADC2. This difference is caused by differences of static reference. An electrical correction adapted to each aircraft is applied to make the ADC1 and ADC2 output parameters identical in cruise flight at mach 2.

2. Correction Procedure

The correction is made by an aircraft modification and by an internal modification of the ADC computers.

A. The individual correction to each aircraft system is made by :

R (1) Modification of wiring between ADC connectors 1F71 and 2F71 and the outputs of diode/resistor assemblies W515 and W525 on shelves 6-215 and 6-216 at the rear of the ADC racks.

(2) Addition of a gain correction resistor across two terminals of the ADC in diode/resistor assembly W525, shelf 6-216.

R

B. The ADC correction consists of replacement of the Pressure Correction electronic card and the use of two extra operational amplifiers. On the aircraft this modification is carried out by :

(1) Replacement of the two computers, ADC1 and ADC2.

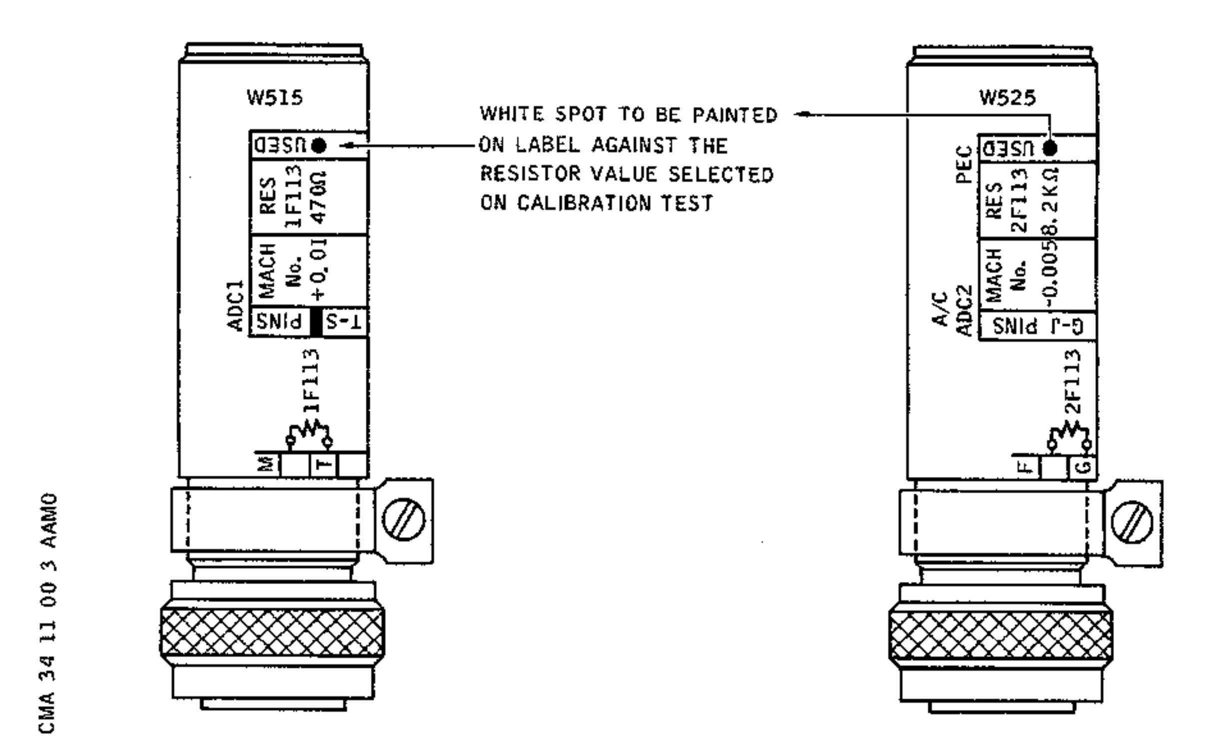
NOTE : Unmodified computers cannot be used on a modified aircraft.

C. Identification of the Correction (Ref. Fig.301 and 302)

(1) On diode/resistor assembly covers W515 and W525, a label with a white spot identification mark indicates
R absence or value of correction resistors in 1F113 and
R 2F113 positions.

(2) A label marked "ADC1 pressure error correction" or "ADC2 pressure error correction" is attached to a leg of electronics racks 215 and 216.

D. Effects of the correction during ground tests.



Identification of Diode and Resistor Assembly
W515 and W525
Figure 301

(1) In self-test operation, a device cancels the ΔM and ΔZ corrections leaving the values unchanged.

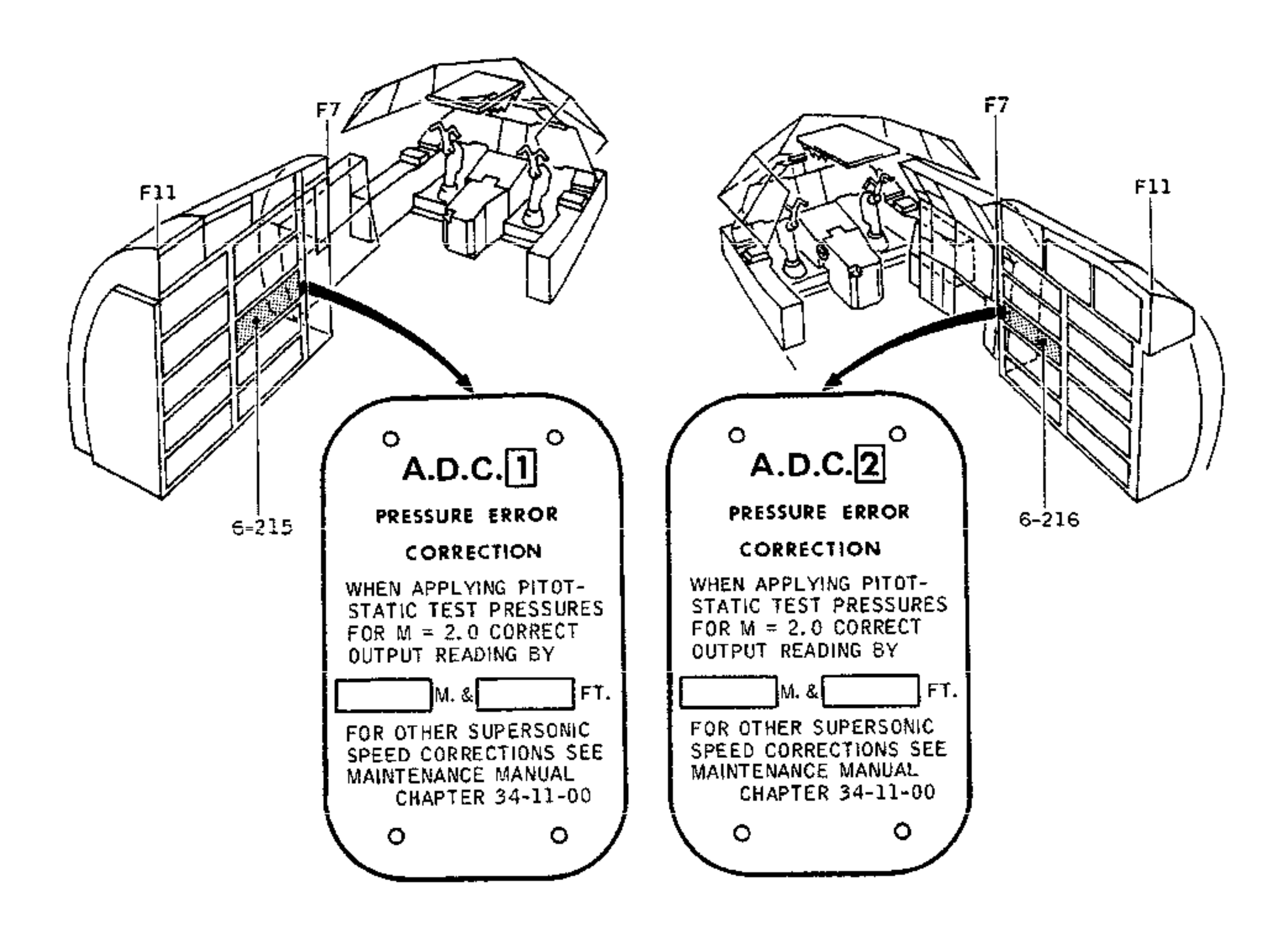
(2) During tests with a pressure generator or pressure sensor simulator, values read at M=2 are corrected by ΔM and ΔZ marked on the labels on each leg of electronics racks 215 and 216. The value will be M read = M nominal + ΔM ± 0.02.

R 3. <u>Measurement of static pressure difference between</u>
R <u>Air Data System 1 and 2</u>

R B A. General

R B The following test describes the procedure for in-flight
R B measurement of the difference between systems 1 and 2
R B with a view to applying corrections if necessary.

R B B. Test Preparations.
R B (Ref. Fig. 303)



AFTER CALIBRATION TEST, MACH No. & FEET CORRECTION VALUES ARE ENGRAVED. WHERE NO CORRECTION IS REQUIRED THE WORD 'STANDARD' IS ENGRAVED

THE LABEL (S) MUST HAVE THE <u>OPPOSITE SIGN</u> TO THE MACH No. SHOWN ON DIODE ASSEMBLY. IF ON W515 THE CORRECTION IS + 0.010 (470 OHMS RESISTOR FITTED) THE ADC 1 LABEL WOULD READ : READING BY [- 0.010M] & [+250 ft.]

CMA 34 11 00 3 ACMO

R

Labels - Racks 215 and 216
Figure 302

(1) Measure ΔHp error on First Officer altimeter in Standby mode for $50000\ ft < Hp < 60000\ ft$ by means of a pressure generator connected to nose probe.

(2) Visually check nose probe for correct condition as it constitutes the reference element for flight test (ref. 34-13-33, page 601, Nose Probe Inspection/ Check).

(3) In LH electronics rack, install two calibrated differential pressure gauges (with measurement range approximately ± 15 mb, and resolution approximately 0.2 mb on Badin Crouzet type 20 gauges, for example) and connect them to air data systems as in Figure 303.

<u>NOTE</u> : To avoid damage to pressure gauges make certain that static pressure is simultaneously applied to lateral static ports and to nose probe after installation and during any ground test.

C. In-Flight Test

For flight conditions stabilized at approximately Hp = 51000 ft and M = 2.00 carry out simultaneously the following operations :

(1) Altitude (Hpl) read on flight engineer altimeter in standby configuration.

(2) Differential pressures ± Δ pa 1 (mb) and ± Δ pa 2 (mb) read directly on gauges in racks.

Δ pa 1 = nose probe pa - ADC1 lateral static port pa.

Δ pa 2 = nose probe pa - ADC2 lateral static port pa.

pa = static pressure.

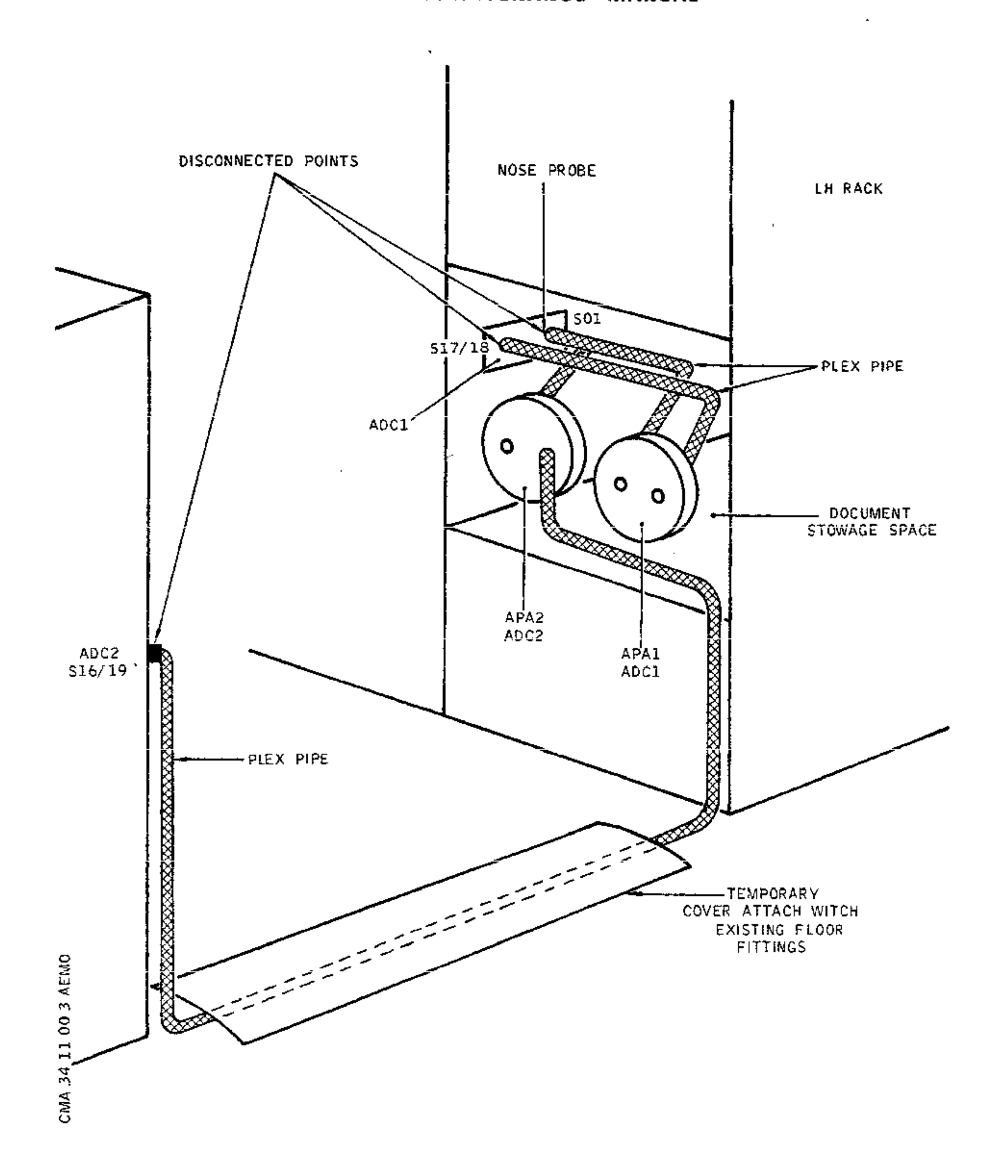
D. Determination of Correction Resistance

(1) Determination real altitude supplied by nose probe, and allowing for indicator error :

$$Hp = Hp1 \pm \Delta Hp$$

(2) Determine atmospheric pressure pa (mb) corresponding to the altitude Hp, using the table 301 taken from Atmosphere Manual.

(3) Resolve the relation $\Delta p/pa = \Delta pa + 1.2/pa$ for ADC1 and ADC2.



R Differential Pressure Gauge Installation B
Figure 303

(The value 1.2 mb corresponds to the theorical static pressure difference detected by the nose probe and ADC static ports, taking into account certification calibrations and the laws of correction).

(4) Define the Mach error (DM) for ADC1 and ADC2 by referring to the table below :

$\frac{\Delta p}{pa}$	Δ M
0.006	0.005
0.012	0.010
0.017	0.015
0.022	0.020
0.027	0.025
0.032	0.030

(5) Determine the Δ M Sign, taking into account the following relations :

Δ M = M nose probe - M lateral static ports

if Δ p>0 : M<0

if Δ p<0 : M>0

(6) Determine correction resistance by reference to the following table :

Δ M	Resistance	Corresponding altitude correction Hp (ft.)
- 0.030	100Ω between J2A35 and J2A36	- 690
- 0.025	470Ω " " "	- 575
- 0.020	1000Ω " " "	- 455
- 0.015	1800Ω " " "	- 350
- 0.010	3600Ω " " "	- 250
- 0.005	8200Ω " " "	- 125
+ 0.005	6800Ω " " J2A34	+ 125
+ 0.010	470Ω " " "	+ 250

R B E. Modification Accomplishment on the Aircraft

R B The installation of correction resistances in units W515
R B and W525, and the modification of placards, is accompli-
R B shed according to SB 34016.

R B F. Cross-Reference table

R B (1) Determine the altitude in corresponding atmospheric
R B pressure by reference to the following table 301 :

pa (mb)	Hp (ft)	pa (mb)	Hp (ft)	pa (mb)	Hp (ft)	pa (mb)	Hp (ft)
125.0	48440	105.5	51969	94.4	54282	86.6	56076
124.5	48524	105.0	52068	94.2	54326	86.4	56125
124.0	48607	104.5	52167	94.0	54370	86.2	56173
123.5	48692	104.0	52267	93.8	54415	86.9	56221
123.0	48776	103.5	52367	93.6	54459	85.8	56270
122.5	48861	103.0	52468	93.4	54504	85.6	56318
122.0	48946	102.5	52569	93.2	54548	85.4	56367
121.5	49031	102.0	52671	93.0	54593	85.2	56416
121.0	49117	101.5	52773	92.8	54638	85.0	56464
120.5	49203	101.0	52876	92.6	54683	84.8	56513
120.0	49290	100.5	52979	92.4	54728	84.6	56563
119.5	49377	100.0	53083	92.2	54773	84.4	56612
119.0	49464	99.8	53125	92.0	54818	84.2	56661
118.5	49551	99.6	53166	91.8	54863	84.0	56711
118.0	49369	99.4	53208	91.6	54909	83.8	56760
117.5	49728	99.2	53250	91.4	54954	83.6	56810
117.0	49816	99.0	53292	91.2	55000	83.4	56860
116.5	49906	98.8	53334	91.0	55045	83.2	56910
116.0	49995	98.6	53376	90.8	55091	83.0	56960
115.5	50085	98.4	53419	90.6	55137	82.8	57010
115.0	50175	98.2	53461	90.4	55183	82.6	57060
114.5	50266	98.0	53503	90.2	55229	82.4	57111
114.0	50357	97.8	53546	90.0	55275	82.2	57161
113.5	50448	97.6	53589	89.8	55321	82.0	57212
113.0	50540	97.4	53631	89.6	55368	81.8	57263
112.5	50632	97.2	53674	89.4	55414	81.6	57314
112.0	50725	97.0	53717	89.2	55461	81.4	57365
111.5	50818	96.8	53760	89.0	55508	81.2	57416
111.0	50912	96.6	53803	88.8	55554	81.0	57467
110.5	51006	96.4	53846	88.6	55601	80.8	57519
110.0	51100	96.2	53889	88.4	55648	80.6	57570
109.5	51195	96.0	53932	88.2	55696	80.4	57622
109.0	51290	95.8	53976	88.0	55743	80.2	57674
108.5	51386	95.6	54019	87.8	55790	80.0	57726
108.0	51482	95.4	54063	87.6	55838	79.8	57778
107.5	51578	95.2	54107	87.4	55885	79.6	57830
107.0	51675	95.0	54150	87.2	55933	79.4	57882
106.5	51773	94.8	54194	87.0	55981	79.2	57935
106.0	51871	94.6	54238	86.8	56028	79.0	57987

pa (mb)	Hp (ft)	pa (mb)	Hp (ft)	pa (mb)	Hp (ft)	pa (mb)	Hp (ft)
78.8	58040	76.6	58629	74.4	59236	72.2	59860
78.6	58093	76.4	58684	74.2	59292	72.0	59918
78.4	58146	76.2	58738	74.0	59348	71.8	59976
78.2	58199	76.0	58793	73.8	59404	71.6	60034
78.0	58253	75.8	58848	73.6	59461	71.4	60092
77.8	58306	75.6	58903	73.4	59517	71.2	60150
77.6	58360	75.4	58958	73.2	59574	71.0	60209
77.4	58413	75.2	59013	73.0	59631	70.8	60268
77.2	58467	75.0	59069	72.8	59688	70.6	60326
77.0	58521	74.8	59124	72.6	59745	70.4	60385
76.8	58575	74.6	59180	72.4	59803	70.2	60445

Atmospheric Pressure and Corresponding Altitude
Table 301

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) With aircraft in ground configuration, shock absorbers compressed.

(2) On centre console 9-211 make certain on ADC control panel that :

(a) ADC 1 and ADC 2 ON-OFF switches are in OFF position.

(b) TEST selector switches are in NORM position.

(3) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH W/SCREEN WIPER SUP	1-213	1H 72	J 8
LH UC WEIGHT SW A SYS SUP		G 292	M17
AUDIO WARN SYS SUP 1		W 371	M21
MWS SUP 1		W 252	N21
ADC 1 28 V SUP		1F 74	P12
STICK SHAKER SUP		W 513	P15
NOSE 7 1/2° CONT		M 12	Q16
VISOR SERVICES A SYS CONT		M 14	Q18
AUDIO WARN O/SPEED SUP 1		W 374	S19
1ST PLT ADC INST SUP	2-213	1F 85	B 3
ADC 1 26 V SUP		1F 78	A 2
1ST PLT VSI SUP		1F 97	A 3
LH W/SCREEN WIPER SUP		1H 71	E23
ADC 1 115 V SUP		1F 73	F 3
RH UC WEIGHT SW B SYS SUP	3-213	G 294	B 9

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT TEST 115 VAC SUP	4-213	X 481	B22
AUDIO WARN SYS SUP 2	5-213	W 372	C17
AUDIO WARN O/SPEED SUP 2		W 373	C18
MWS SUP 2		W 251	D15
ADC 2 28 V SUP		2F 74	F12
PLT'S LT TEST SUP	15-215	L1001	E14
VISOR & NOSE CONT IND		M 11	F 8
VISOR & NOSE CONT IND		M 15	F 9
2ND PLT ADC INST SUP	13-216	2F 75	A14
3CM ADC TEMP INST SUP		F 105	A15
2ND PLT VSI SUP		2F 97	B13
FLT TEST 26 VAC SUP		X 480	B18
ADC 2 26 V SUP		2F 78	F14
ADC 2 115 V SUP		2F 73	F15
RH W/SCREEN WIPER SUP	14-216	2H 71	D15
RH W/SCREEN WIPER CONT	15-216	2H 72	A15
VISOR SERVICES B SYS CONT		M 16	D18

**ON A/C 001-005,

CABIN MACHMETER 115VAC SUP	13-216	3F 73	C18
CABIN MACHMETER 28VDC SUP	15-216	3F 74	A20

R **ON A/C 006-007,

CABIN MACHMETER 115VAC SUP	13-216	F 118	C18
CABIN MACHMETER 28VDC SUP	15-216	F 117	A20

(4) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(5) Switch on electronics rack ventilation system (Ref. 21-21-00).

(6) Reset the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13X	13-216	X 345	G 4

(7) Captain (2-211) and First Officer (2-212) instrument panels.

(a) On altimeter :

(a1) By means of button at lower left, select barometric pressure of 1013 mb (29.92 in Hg) on counters.

(a2) Make certain that mode selector knob at lower right is positioned so that letter N (normal) is visible and that flag indicates ADC.

(b) On airspeed indicator :

(b1) Make certain that mode selector knob at lower right is positioned so that letter N (normal) is visible, and that flag indicates ADC.

(8) On centre console 9-211, place LIGHTS/LO-HI-TEST switch (L1008) in TEST position.

(a) Make certain on ADC control panel that blue TEST indicator lights and amber ADC 1 and ADC 2 warning lights illuminate.

(b) Place LIGHTS/LO-HI-TEST switch in HI position, blue TEST indicator lights and amber ADC 1 and ADC 2 warning lights on ADC control panel extinguish.

(9) In zone 221, on Steward panel 1-221, place CABIN MACH INDICATORS ON/OFF switch in ON position and BRIGHT/DIM switch in BRIGHT position.

C. ADC 1 or ADC 2 System Test in Self-Test Mode

NOTE : As ADC 1 and ADC 2 systems are similar, a common test is described. If differences occur, the system

concerned will be mentioned.

(1) Start Up

(a) On centre console 9-211 ADC control panel, place ADC 1 (ADC 2) ON-OFF switch in ON position.

(b) After approximately 30 seconds, press and release amber ADC 1 (ADC 2) warning light, which remains extinguished.

(c) On Captain (First Officer) instrument panel, make certain that warning flags on the following instruments are not visible :

- Airspeed indicator
- Machmeter
- Altimeter
- Angle of attack indicator
- Temperature indicator
- Vertical speed indicator

(d) On panel 4-214 on Flight Engineer panel, make certain that warning flag is not visible on :

- Digital machmeter (for ADC 1)
- Digital altimeter (for ADC 2)

(2) Monitor test

(a) On centre console 9-211 ADC control panel, place test selector switch on system under test in MON position and check that :

(a1) Blue TEST indicator lights and amber ADC 1 (ADC 2) warning lights illuminate on ADC control panel.

(a2) Amber ADC warning light illuminates on master warning panel, panel 4-211.

(a3) Gong aural warning sounds.

(a4) On Captain (First Officer) instrument panel warning flags appear on following instruments :

- Airspeed indicator
- Machmeter
- Altimeter
- Angle of attack indicator

- Vertical speed indicator
- Temperature indicator (Except STATIC and TOTAL flags).

(a5) On panel 4-214 Flight Engineer panel, make certain that warning flags are visible on :

- Digital machmeter (for ADC 1)
- Digital altimeter (for ADC 2)

NOTE : During this test, if amber ADC 1 (ADC 2) warning light on ADC control panel is pressed, ADC warnings are inhibited but reappear when warning light is released.

(3) Test 1 (Simulation of a subsonic flight condition and stick shaker check)

NOTE : If this test is used for check of a peripheral system which does not require the stick shaker, trip circuit breaker W513 (position P15) on panel 1-213.

(a) On centre console 9-211 ADC control panel, place test selector switch on system under test in 1 position.

- Some warnings appear.

(b) After some seconds, blue TEST indicator light on system under test illuminates on ADC control panel.

(c) At pilot stations, Captain and First Officer control columns vibrate and gong aural warning sounds (except if circuit breaker W513 has been tripped).

(d) On centre console 9-211, press and release amber ADC 1 (ADC 2) warning light on ADC control panel, the light extinguishes and the other ADC warnings disappear.

(e) On the following instruments on Captain (First Officer) instrument panel, read values given in the following table :

INSTRUMENTS	PARAMETERS	VALUES
Altimeter	Hp in ft	10,000 ± 30
Airspeed Indicator	Vc in kts	350 ± 3
Machmeter	M	0.63 ± 0.01
Angle of Attack Indicator	Alpha in (°)	21.5 ± 0.5
R Temperature Indicator	Tt in (°C) Ts in (°C) ISA in (°C)	+10 ± 2 -11 ± 2.5 -6.2 ± 3.5

(f) On panel 4-214, flight engineer panel, read on :

- Digital machmeter (ADC 1), value M = 0.63±0.03
- Digital altimeter (ADC 2), value Hp in ft = 10,000 ± 150.

(g) On cabin machmeters, zones 221 and 224, operated by ADC2, check that digital display is M = 0.63.

(4) Test 2 (Simulation of a supersonic flight condition and overspeed warning check)

NOTE : If this test is used for check of a peripheral system, droop nose position of 12.5° is not required.
In this case, blue TEST indicator light does not illuminate and overspeed warning cannot operate.

(a) Place, or make certain that droop nose is placed in 12.5° position (Ref. 27-61-00, Adjustment/Test)

(a1) The overspeed warning (warbler aural warning) sounds. The warning can be cancelled by pressing blue TEST indicator light on ADC control panel.

NOTE : Warning given by test 1.

(b) On centre console 9-211 ADC control panel, place test selector switch on system under test in 2 position :

- Some ADC warnings appear.

(c) After some seconds blue TEST indicator light on system under test illuminates on ADC control panel.

(d) Overspeed aural warning (warbler, 12.5 Hz, duration 2 seconds on, 1 second off) sounds.

(e) On centre console 9-211 ADC control panel, press and release amber ADC 1 (ADC 2) warning light which extinguishes, the other ADC warnings disappear.

(f) Overspeed warning (warbler aural warning) continues to sound and can be cancelled by pressing blue TEST indicator light on ADC control panel.

(g) On following instruments on Captain (First Officer) instrument panel, read values given in following table :

	INSTRUMENTS	PARAMETERS	VALUES
	Altimeter	Hp in ft	48,000 ± 120
B	Airspeed Indicator	Vc in kts	555 ± 5
	Machmeter	M	2 ± 0.01
	Angle of Attack Indicator	Alpha in (°)	3.4 ± 0.5
R	Temperature Indicator	Tt in (°C)	+135 ± 2
		Ts in (°C)	-46.5 ± 2.5
B		ISA in (°C)	+10 ± 3.5

(h) On panel 4-214, Flight Engineer panel read on :

- Digital machmeter (ADC 1) value M = 2 ± 0.03
- Digital altimeter (ADC 2) value Hp in ft = 48,000 ± 200.

(i) On cabin machmeters, zones 221 and 224, operated by ADC2, check that digital display is M = 2.00.

(j) On centre console 9-211 ADC control panel, place test selector switch on system under test in NORM position.

R (j1) Blue TEST indicator light on system under test extinguishes and certain ADC warnings appear.

R (j2) Warbler overspeed warning ceases.

R (j3) Above instruments return to their initial values and warning flags appear.

R (j4) At pilot stations, Captain and First Officer control columns vibrate momentarily and aural warning horn sounds (VLA) if circuit breaker W513 is set.

R (k) On centre console 9-211 ADC control panel, press and release amber ADC 1 (ADC 2) warning light :

- ADC warnings disappear.

(5) Comparator test

NOTE : This test can be carried out in flight or on the ground and by either ADC 1 or ADC 2 test selector switch.

(a) On centre console 9-211, ADC control panel :

(a1) Make certain that test selector switches are in NORM position.

(a2) Place ON-OFF switches on ADC 2 and ADC 1 systems in ON position.

(a3) After approximately 30 seconds, press and release amber ADC 2 and ADC 1 warning lights, which remain extinguished, then make certain that warning flags are not visible on following instruments :

- Captain and First Officer instrument panels
- Airspeed indicator
- Altimeter
- Machmeter
- Angle of attack indicator
- Temperature indicator

(a4) On flight engineer panel 4-214, flag is not visible on :
- Digital altimeter (for ADC2)
- Digital machmeter (for ADC1)

(b) On centre console 9-211 ADC control panel, place test selector switch on one system in COMP position and check :

(b1) On master warning panel, on 4-211, that red ADS warning light illuminates.

(b2) That gong aural warning sounds approximately every 10 seconds.

(b3) On Captain and First Officer airspeed indicators that warning flags appear.

(b4) On ADC control panel that blue TEST indicator light associated with selector switch used above illuminates.

(c) On centre console 9-211 ADC control panel, place test selector switch used above in NORM position and check :

(c1) On master warning panel, on panel 4-211, that red ADS warning light extinguishes.

(c2) That gong aural warning ceases.

(c3) On Captain and First Officer airspeed indicators that warning flags have disappeared.

(c4) On ADC control panel that blue TEST indicator light extinguishes.

(d) On centre console 9-211 ADC control panel, place ADC 1 and ADC 2 ON-OFF switches in OFF position.

(e) On Steward panel 1-221 place CABIN MACH INDICATOR ON/OFF switch on OFF position.

D. Close-Up

(1) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 11XS	2-213	X 355	H 2
NAV INST BUS 13X	13-216	X 345	G 4

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Static Ports Adapter	T8751E22783002
Static Ports Adapter	T8751E22783003
Pitot Tube Adapter	853BFT025
Electrical Ground Power Unit	
Pressure Generator	
Pitot Tube Drain Port Blanking Plug	853BFT026
Access Platform, Height of Access 4 m (13 ft.)	
Decade Box	

B. Prepare

(1) With aircraft in ground configuration, shock absorbers compressed.

(2) On centre console 9-211, make certain on ADC control panel that :

(a) ADC 1 and ADC 2 ON-OFF switches are in OFF position.

(b) TEST selector switches are in NORM position.

(3) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH W/SCREEN WIPER SUP	1-213	1H 72	J 8
STBY 1 BOUNDARY WARN SUP		Q1367	L18
LH UC WEIGHT SW A SYS SUP		G 292	M17
AUDIO WARN SYS SUP 1		W 371	M21
MWS SUP 1		W 252	N21
ADC 1 28 V SUP		1F 74	P12

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STICK SHAKER SUP		W 513	P15
NOSE 7 1/2° CONT		M 12	Q16
VISOR SERVICES A SYS CONT		M 14	Q18
AUDIO WARN O/SPEED SUP 1		W 374	S19
ADC 1 26 V SUP	2-213	1F 78	A 2
1ST PLT VSI SUP		1F 97	A 3
TANKS 9,10,11FQI CH A & PLTS CG IND SUP		Q1358	A18
TANKS 5, 5A & 6 FQI SUP		Q1359	A22
TANKS 1 & 2 FQI SUP		Q1360	A23
STBY 1 CG LIMITS & CG COMPN SUP		Q1361	A24
1ST PLT ADC INST SUP		1F 75	B 3
STBY 1 MACH LIMITS COMPN SUP		Q1362	B23
TOTAL FUEL & MAIN CG COMPN SUP		Q1363	B24
LH W/SCREEN WIPER SUP		1H 71	E23
ADC 1 115 V SUP		1F 73	F 3
RH UC WEIGHT SW B SYS SUP	3-213	G 294	B 9
STBY 2 BOUNDARY WARN SUP		Q1366	F 7
TANKS 9,10,11 FQI CH B & 3CM CG IND SUP	4-213	Q1356	B 1
STBY 2 CG LIMITS & CG COMPN SUP		Q1357	B 2
FLT TEST 115 VAC SUP		X 481	B22
TANKS 3 & 4 FQI SUP		Q1354	C 1
TANKS 7, 7A & 8 FQI SUP		Q1355	C 2
AUDIO WARN SYS SUP 2	5-213	W 372	C17
AUDIO WARN O/SPEED SUP 2		W 373	C18
MWS SUP 2		W 251	D15
ADC 2 28 V SUP		2F 74	F12
TANKS 9,10,11 REFUEL FQI & FLT CONT SUP	13-215	Q1365	C17
PLT'S LT TEST SUP	15-215	L1001	E14
VISOR & NOSE CONT IND		M 11	F 8
VISOR & NOSE CONT IND		M 15	F 9
FQI CONT PNL WARN & FQI TEST SUP		Q1021	G25

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
2ND PLT ADC INST SUP	13-216	2F 75	A14
3CM ADC TEMP INST SUP		F 105	A15
2ND PLT VSI SUP		2F 97	B13
FLT TEST 26 VAC SUP		X 480	B18
STBY 2 MACH LIMITS COMPN SUP		Q1364	D 3
ADC 2 26 V SUP		2F 78	F14
ADC 2 115 V SUP		2F 73	F15
RH W/SCREEN WIPER SUP	14-216	2H 71	D15
RH W/SCREEN WIPER CONT	15-216	2H 72	A15
VISOR SERVICES B SYS CONT		M 16	D18
**ON A/C 001-005,			
CABIN MACHMETER 115VAC SUP	13-216	3F 73	C18
CABIN MACHMETER 28 VDC SUP	15-216	3F 74	A20
R **ON A/C 006-007,			
CABIN MACHMETER 115VAC SUP	13-216	F 118	C18
CABIN MACHMETER 28VDC SUP	15-216	F 117	A20

(4) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(5) Switch on electronics rack ventilation system (Ref. 21-21-00).

(6) Reset the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS13X	13-216	X 345	G 4

(7) Captain and First Officer instrument panels (2-211) (2-212) :

(a) On altimeter :

(a1) Select by means of knob at lower left, barometric pressure of 1013 mb (29.92 in Hg) on counters.

(a2) Make certain that mode selector knob at lower right is positioned so that letter N (normal) is visible, and that flag indicates ADC.

(b) On airspeed indicator :

(b1) Make certain that mode selector knob at lower right is positioned so that letter N (normal) is visible, and that flag indicates ADC.

(8) On centre console 9-211, place LIGHTS LO-HI TEST switch (L1008) in TEST position.

(a) Make certain on ADC control panel that blue TEST indicator lights and amber ADC 1 and ADC 2 warning lights illuminate.

(b) Place LIGHTS/LO-HI TEST switch in HI position, blue TEST indicator lights and amber ADC 1 and ADC 2 warning lights on ADC control panel extinguish.

(9) On panel 5-214, Flight Engineer panel, select by means of ZFW (Zero Fuel Weight) knob, a value between 76 and 96 tons so as to read on A/C WEIGHT counter a weight of 100 - 120 - 140 or 165 tons.

(10) In zone 221, on Steward panel 1-221 place CABIN MACH INDICATORS ON/OFF switch in ON position and BRIGHT/DIM switch in BRIGHT position.

C. ADC 1 or ADC 2 System Test Self-Test Mode

NOTE : As ADC 1 and ADC 2 systems are similar a common test is described. If differences occur, the system concerned will be mentioned.

(1) Start Up

Refer to start up procedure for operational test, paragraph 1. C. (1).

(2) MONITOR Test

Refer to monitor test procedure for operational test, paragraph 1. C. (2).

(3) TEST 1 (Simulation of a subsonic flight condition and stick shaker check)

NOTE : If this test is used for check of a peripheral system which does not require the stick shaker, trip circuit breaker W513 (position P15) on panel 1-213.

(a) Repeat procedure in operational test, paragraphs 1. C. (3) (a) to 1. C. (3) (d) inclusive.

(b) On following instruments on Captain (First Officer) instrument panel, read values given in the following table :

NOTE : As VMO and MMO values are a function of A/C WEIGHT up to 43,000 ft, values according to selected weights are given in a following table :

INSTRUMENTS	PARAMETERS	VALUES
Altimeter	Hp in ft	10,000 ± 30
Airspeed Indicator	Vc in kts VMO in kts	350 ± 3 See table f (w)
Machmeter	M MMO	0.63 ± 0.01 See table f (w)
Angle of Attack Indicator	Alpha in (°)	21.5 ± 0.5
R Temperature Indicator	Tt in (°C) Ts in (°C) ISA in (°C)	+10 ± 2 -11 ± 2.5 -6.2 ± 3.5

(b1) Table of MMO and VMO values according to weight W at 10,000ft.

WEIGHT	VMO	MMO
100 Tonnes	380 ± 4	0.68 ± 0.03
120 Tonnes	385 ± 4	0.69 ± 0.03
140 Tonnes	391 ± 4	0.70 ± 0.03
165 Tonnes	400 ± 4	0.72 ± 0.03

(c) On panel 4-214, Flight Engineer panel read on :

- Digital machmeter (for ADC 1) value M = 0.63 ± 0.03
- Digital altimeter (for ADC 2) value Hp in ft = 10,000 ± 150

R (d) On cabin machmeters, zones 221 and 224, operated
R by ADC2, check that digital display is M = 0.63.

(4) Test 2 (Simulation of a supersonic flight condition and overspeed warning check)

NOTE : If this test is used for check of a peripheral system, droop nose position of 12.5° is not required.
In this case, blue TEST indicator light does not illuminate and overspeed warning cannot operate.

(a) Place, or make certain that droop nose is placed in 12.5° position (Ref. 27-61-00, Adjustment/ Test).

(a1) The overspeed warning (warbler aural warning) sounds. The warning can be cancelled by pressing blue TEST indicator light on ADC control panel.

NOTE : This warning is given by test 1.

(b) Repeat procedure in operational test, paragraphs 1. C. (4) (b) to 1. C. (4) (f) inclusive.

(c) On following instruments on Captain (First Officer) instrument panel read values given in following table :

NOTE : VMO and MMO values do not vary above 43,000 ft irrespective of aircraft weight W.

INSTRUMENTS	PARAMETERS	VALUES
Altimeter	Hp in ft	48,000 ± 120
Airspeed Indicator	Vc in kts VMO in kts	555 ± 4 530 ± 4
Machmeter	M MMO	2 ± 0.01 1.9 ± 0.03
Angle of Attack Indicator	Alpha in (°)	3.4 ± 0.5
R Temperature indicator	Tt in (°C) Ts in (°C) ISA in (°C)	+135 ± 2 -46.5 ± 2.5 +10 ± 3.5

B

(d) On panel 4-214 Flight Engineer panel, read on :

- Digital machmeter (for ADC 1) value M = 2 ± 0.03
- Digital altimeter (for ADC 2) value Hp in ft = 48,000 ± 200

(e) On cabin machmeters, zones 221 and 224, operated by ADC2, check that digital display is M = 2.00.

(f) Repeat procedure in operational test paragraphs 1. C. (4) (j) to 1. C. (4) (k).

(5) Comparator test

Refer to comparator test procedure for operational test paragraph 1. C. (5).

E. ADC 1 or ADC 2 System Test with Pressure Generator

NOTE : As ADC 1 and ADC 2 systems are similar, a common test is described. Equipment or zones concerning ADC 2 system are indicated in parentheses. However if differences occur, the system concerned will be mentioned.

(1) Start Up

(a) On centre console 9-211, make certain on ADC

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control panel that :

(a1) ADC 1 and ADC 2 ON-OFF switches are in OFF position.

(a2) Test selector switches are in NORM position.

(b) On panel 4-211, make certain that ADS AND ENG PROBE HEATERS switches are in OFF position.

(c) Place pressure generator in position.

(d) Zone 124, place access platform under static port 1H20 (S18) or (2H20) (S16) :

(d1) Remove static port cover if necessary

(d2) Connect static port adapter T8751E22783002 to static port 1H20 (adapter T8751E22783003 to static port 2H20) making certain that blanking plug is correctly positioned in its aperture.

(e) Zone 123, place access platform under static port 1H19 (S17), (2H19) (S19).

(e1) Remove static port cover if necessary

(e2) Connect static port adapter T8751E22783003 to static port 1H19 (adapter T8751E22783002 to static port 2H19) and connect adapter output to PS output on pressure generator by means of a pressure line.

(f) Zone 113 (114), place access platform under pitot head 1H16 (P03) (2H16)(P02).

(f1) Remove static port cover if necessary

(f2) Connect pitot tube adapter 853BFT025 to pitot tube and connect to PT output on pressure generator by means of a pressure line.

(f3) Place pitot tube drain port blanking plugs 853BFT026 on tube drain port.

(g) Zone 113 (114), position access platform and open access door 113BB to total temperature probe 1F98 (2F98).

(g1) Remove cover from probe if necessary.

(g2) Remove connector 1F98A (2F98A) from temperature probe in use, then connect decade box to cable mounted connector between pins J and F and shunt pins F and E.

(h) Zone 113 (114), place access platform under angle of attack sensor 1F91 (2F91) and remove protective cover if necessary.

(i) Trip the following circuit breakers according to system in use :

(i1) For ADC 1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SENSOR UNIT 1 SUP	2-213	1K2052	A14

(i2) For ADC 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SENSOR UNIT 3 SUP	2-213	3K2052	G14
SENSOR UNIT 4 SUP	14-216	4K2052	C 5

(j) On pressure generator, select static pressure PS = 1013.2 mb and pressure delta P = 0 mb.

(k) Start up ADC 1 (ADC 2) system, ref. paragraph 1. C. (1) in operational test.

(l) Switch on pressure generator.

NOTE : When operating pressure generator or pressure sensor simulator, for altitude and mach number corrections to be applied, refer to chapter 34-11-00, Servicing.

According to the generator characteristics, carry out a leakage test using one of the following procedures .

(l1) Select on generator PS 70 mb and Delta P 425 mb. Turn angle of attack sensor vane

(1F91) (zone 113) or (2F91) (zone 114) to obtain 2° reading on angle of attack indicator (1F83) (panel 2-211) or (2F83) (panel 2-212) and hold in this position.
Reading on altimeter (1F79) (panel 2-211) or (2F79) (panel 2-212) is approximately 60800 ft. Isolate air data line system from generator.
PS system : after 5 minutes, reading deviation value must not exceed 500 ft.
Select PS 151 mb and Delta P 600 mb.
Read on airspeed indicator (1F81) (panel 2-211) or (2F81) (panel 2-212) speed of approximately 543.3Kt. Isolate air data line system from generator.
PT system : after 10 minutes reading deviation must not exceed 2 Kt.

(l2) Select on generator PS 300 mb and Delta P 425 mb. Turn angle of attack sensor vane (1F91) (zone 113) or (2F91) (zone 114) to obtain 2° reading on angle of attack indicator (1F83) (panel 2-211) or (2F83) (panel 2-212) and hold in this position.
Reading on altimeter (1F79) (panel 2-211) or (2F79) (panel 2-212) is 29700 ft., and on airspeed indicator (1F81) (panel 2-211) or (2F81) (panel 2=212) is 476 Kt.
Isolate air data line system from generator
PS system : acceptable leakage 400 ft. in 10 minutes.
PT system : acceptable leakage 2Kt in 10 minutes.

(2) Check of ADC 1 (ADC 2) with droop nose in 0° position.

(a) Place, or make certain that droop nose is placed in 0° position with visor in up position (Ref. 27-61-00, Adjustment/Test).

(b) On decade box select resistance value 686 ohms.

(c) On pressure generator, select the following pressures :

PS = 94.5 mb and Delta P = 479.3 mb

NOTE : A/C WEIGHT was selected in paragraph 2. B. (9).

(d) Position vane on sensor 1F91 (2F91) so as to read

on angle of attack indicator on Captain (First Officer) instrument panel value alpha = 2°.

(e) On instruments on Captain (First Officer) instrument panel, read values given in following table :

INSTRUMENTS	PARAMETERS	VALUES
Altimeter	Hp in ft	54,440 ± 160
Airspeed Indicator	Vc in kts VMO in kts	486.7 ± 4 490 ± 4
Machmeter	M MMO	2.05 ± 0.02 2.02 ± 0.03
Angle of Attack Indicator	Alpha in (°)	2 ± 0.5
R Temperature Indicator	Tt in (°C) Ts in (°C) ISA in (°C)	+100 ± 3 -66.3 ± 3 -9.8 ± 3.5

(f) On panel 4-214 Flight Engineer panel, read on :

- Digital machmeter (for ADC 1) value M = 2.05 ± 0.03
- Digital altimeter (for ADC 2) value Hp in ft = 54,410 ± 200

(g) Lower visor (Ref. 27-61-00, Adjustment/Test) and check :

- That overspeed aural warning (warbler) sounds.

(h) On cabin machmeters in zone 221 and 224 (operating from ADC2) check that digital display is M = 2.05.

(3) Check of ADC 1 or ADC 2 with droop nose in 5° position.

(a) Place droop nose in 5° position (Ref. 27-61-00, Adjustment/Test).

(b) On decade box select resistance value 593.5 ohms.

(c) On pressure generator select following pressures :

PS = 692.3 mb and Delta P = 288.5 mb.

(d) Position vane on angle of attack sensor 1F91 (2F91) so as to read on angle of attack indicator on Captain (First Officer) instrument panel, a value alpha = 2°.

(e) Warbler overspeed aural warning no longer sounds.

(f) On instruments on Captain (First Officer) instrument panel, read values given in following tables :

INSTRUMENTS	PARAMETERS	VALUES
Altimeter	Hp in ft	10,050 ± 50
Airspeed Indicator	Vc in kts VMO in kts	401 ± 4 See table f (w)
Machmeter	M MMO	0.71 ± 0.02 See table f (w)
Angle of Attack Indicator	Alpha in (°)	2 ± 0.5
Temperature Indicator	Tt in (°C) Ts in (°C) ISA in (°C)	50 ± 2.5 19.87 ± 3 24 ± 3.5

R (f1) On cabin machmeters in zone 221 and 224 (operating from ADC2) check that digital display is M = 0.71.

(f2) Table of VMO and MMO values with respect to weight (W)

WEIGHT	VMO	MMO
100 Tonnes	380 ± 4	0.68 ± 0.03
120 Tonnes	385 ± 4	0.69 ± 0.03
140 Tonnes	391.5 ± 4	0.70 ± 0.03
165 Tonnes	400 ± 4	0.72 ± 0.03

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(g) On panel 4-214 Flight Engineer panel read on :

- Digital machmeter (for ADC 1) value M = 0.71 ± 0.03
- Digital altimeter (for ADC 2) value Hp in ft = 10,050 ± 150

(4) ADC 1 or ADC 2 system test with droop nose in 12.5° position.

(a) Place droop nose in 12.5° position (Ref. 27-61-00, Adjustment/Test)

and check :

- That warbler aural warning sounds.

(b) On decade box select resistance value of 555.3 ohms.

(c) On pressure generator select following pressures :

PS = 974.2 mb and Delta P = 39.8 mb

(d) Position vane on angle of attack sensor 1F91 (2F91) so as to read on angle of attack indicator on Captain (First Officer) instrument panel a
R value alpha = 15°

(e) Warbler aural warning no longer sounds.

(f) On following instruments on Captain (First Officer) instrument panel, read values given in following table :

INSTRUMENTS	PARAMETERS	VALUES
Altimeter	Hp in ft	1015 ± 30
Airspeed Indicator	Vc in kts VMO in kts	150.6 ± 4 See table f (w)
R Machmeter	M MMO	Minimum stop See table f (W)
Angle of Attack Indicator	Alpha in (°)	15 ± 0.5

INSTRUMENTS	PARAMETERS	VALUES
Temperature Indicator	Tt in (°C)	30 ± 2.5
	Ts in (°C)	26.2 ± 3
	ISA in (°C)	13 ± 3.5

(f1) Table of VMO and MMO values with respect to weight (W)

WEIGHT	VMO	MMO
100 Tonnes	316.5 ± 4	0.49 ± 0.03
120 Tonnes	317.5 ± 4	0.49 ± 0.03
140 Tonnes	318.5 ± 4	0.49 ± 0.03
165 Tonnes	320 ± 4	0.49 ± 0.03

(g) On Captain instrument panel, read on true airspeed indicator TAS = 164 ± 6 kt (For ADC1 system).

(h) On panel 4-214, Flight Engineer panel :

= Digital machmeter (for ADC 1) is at minimum stop position as mach output from computer is less than 0.25 M.
- Digital altimeter (for ADC 2) indicates Hp in ft = 1015 ± 150.

(i) On pressure generator select Ps = 1013.2 mb and Delta P = 0 mb.

(j) Position vane on angle of attack sensor 1F91 (2F91) so as to read on angle of attack indicator on Captain (First Officer) instrument panel value of 0° ; then fit protective cover on sensor if necessary.

(k) Zone 113 (114), position access platform, disconnect decade box and shunt from cable mounted connector and connect connector to total temperature probe 1F98 (2F98).

(l) On Captain (First Officer) instrument panel, read on temperature indicator Tt value close to ambient

temperature.

(m) On centre console 9-211, ADC control panel, place ON-OFF switch on ADC 1 (ADC 2) system in OFF position.

(n) Switch off pressure generator.

(o) On Steward panel 1-221, place CABIN MACH INDICATORS ON/OFF switch in OFF position.

F. Close-Up

(1) Zone 113 (114) position access platform under pitot head 1H16 (P03) (2H16) (P02) :

(a) Disconnect adapter 853BFT025 from pitot tube

(b) Remove blanking plug 853BFT025 from drain port

(c) Fit protective cover on pitot tube if required.

(2) Zone 123, position access platform under static port 1H19 (S17) (2H19 (S19)) :

(a) Disconnect adapter T8751E22783003 from static port 1H19 (adapter T8751E22783002 from static port 2H19).

(b) Fit protective covers on static ports if required.

(3) Zone 124, position access platform under static port 1H20 (S18) (2H20) (S16) :

(a) Disconnect adapter T8751E22783002 from static port 1H20 (adapter T8751E22783003 from static port 2H20).

(b) Fit protective covers on static ports if required

(4) On pressure generator disconnect and remove pressure lines from pitot tube and static port adapters.

(5) On panel 5-214, Flight Engineer panel, select initial ZFW value.

(6) Reset the following circuit breakers according to system in use :

(a) For ADC 1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SENSOR UNIT 1 SUP	2-213	1K2052	A14

(b) For ADC 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SENSOR UNIT 3 SUP	2-213	3K2052	G14
SENSOR UNIT 4 SUP	14-216	4K2052	CC 5

(7) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13X	13-216	X 345	G 4

(8) Switch off electronics rack ventilation system (Ref. 21-21-00).

(9) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

CONTROL AND INDICATING - DESCRIPTION AND OPERATION

1. General

The air data information developed by the ADC computers is fed to the instruments, providing the continuous flight parameters required by the crew.

2. Description of Instruments

A. The instruments described in the following paragraphs are mounted on the Captain, First Officer, or Flight Engineer instrument panels, and include:

(1) Temperature indicator

(2) Angle of attack and G indicator

(3) Machmeter

(4) Air speed indicator

(5) Vertical speed indicator

(6) Altimeter

(7) Total temperature indicator

(8) Digital machmeter

(9) Digital altimeter

(10) Not applicable

R (11) Cabin machmeters

R (12) TCAS Vertical speed indicators.

B. The instruments are switched on, by means of the relevant air data supply circuit breakers, when the ADC computers are energized.

3. Indicator - Temperature

A. General

R The temperature indicator is used for indication of static, total and international standard atmosphere (ISA) temperatures. The indicators (1F82 and 2F82) are installed on panels 7-211 and 15-214 respectively.

R
R

B. Description (Ref. Fig. 001)

(1) Performance

(a) Temperature ranges

- Total temperature (Tt) - 50°C to + 199°C
- Static temperature (Ts) - 99°C to + 50°C
- Difference temperature (ISA) - 70°C to + 50°C

(b) Altitude Scale

Altitude ranges extend from - 1000 ft to + 80000 ft. Calculated altitude range extends from - 1000 ft to + 36090 ft.

(2) Indications

The temperature indicator is a servo controlled repeater instrument contained in a rectangular housing and having on its dial :

- A total temperature (Tt) display counter.
- A static temperature (Ts) display counter.
- A differential temperature counter, difference between standard temperature and static temperature (Tisa)
- A red maximum operating temperature marker (TMO)
- A total temperature warning (fire orange flag)
- A static temperature warning (fire orange flag)
- A differential temperature warning (fire orange flag)

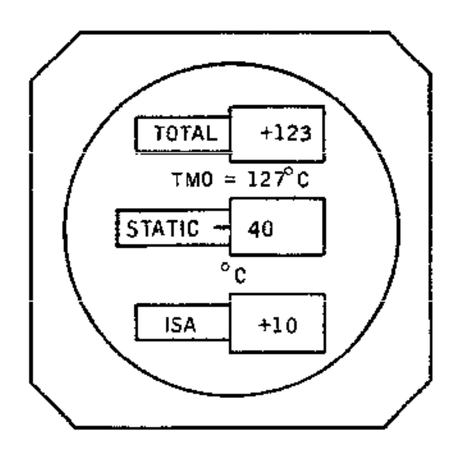
(a) Total Temperature Indication (Ref. Fig. 002)

(a1) Operation

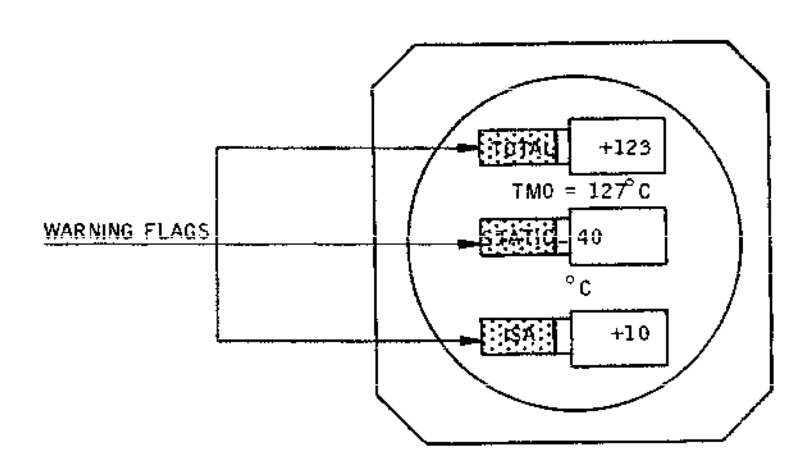
The input circuit uses a chopper which compares the total temperature signal with the signal from a potentiometer supplied with a reference voltage ADC. The difference between the two signals causes an alternating error signal to be generated in the chopper, which is sent to a motor control servo amplifier. The motor drives the total temperature display counter, and also the potentiometer in order to equalise the voltage level at the input.

(a2) Tt Warning

The instrument has a Tt monitor system which



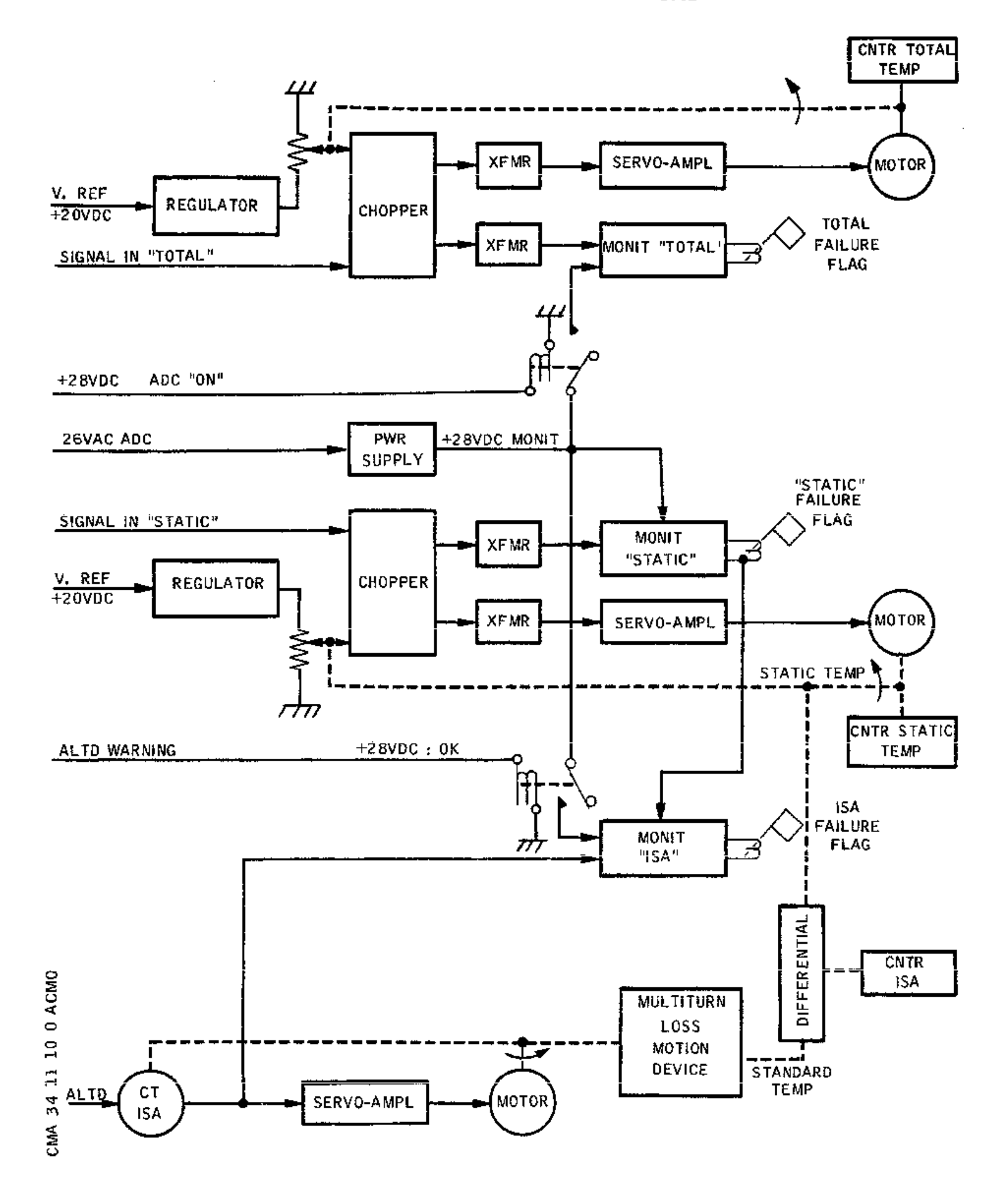
INSTRUMENT IN OPERATION



INSTRUMENT OFF

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Temperature Indicator : Front View
Figure 001



Temperature Indicator : Operation Block Diagram
Figure 002

indicates a fault by means of a flag beside the counter, in the following conditions :

- In case of a servo error.
- A 26VAC power supply fault.
- 28VDC monitor supply fault.
- 28VDC ADC ON supply fault.

The flag does not appear if the instrument follows a temperature variation of 50°C/min. The chopper output signal activates the monitor by means of a transformer. When a fault occurs in the servo system, and if the error signal null is not obtained, the de-energized solenoid causes appearance of the flag.

(b) Static Temperature Indication

(b1) Operation

This circuit operates in a similar manner as the preceding total temperature circuit, but provides supplementary mechanical information for the ISA channel differential.

(b2) Ts Warning

The instrument has a Ts monitor system which indicates a fault by means of a flag beside the counter.
The following faults are indicated :

- Servo error.
- 26VAC power supply fault.
- 28VDC monitor power supply fault.

The flag does not appear if the instrument follows a 50°C min. temperature variation. In case of a servo system fault, and if the error signal null is not obtained, the de-energized solenoid causes appearance of the flag. The Ts monitor output is connected to the ISA monitor to enable appearance of the two flags in case of a Ts channel fault.

(c) ISA Temperature Indication (Tstandard - Tstatic)

(c1) Operation

The differential channel receives an altitude signal from the ADC through a control trans-

former (CT). A servo amplifier supplies the motor control signal. By means of a differential, the ISA counter indicates standard temperature f (HP) minus static temperature from - 1000 ft to 36090 ft. Above 36090 ft a loss motion device is activated, and the counter translates the difference between actual standard temperature at that altitude minus static temperature.

(c2) ISA Warning

All faults are indicated by appearance of a flag to the left of the counter, in the following conditions :

- If an altitude servo error occurs.
- If a static temperature servo error occurs.
- Failure of 26VAC power supply.
- Failure of 28VDC monitor supply.
- Failure of 28VDC altitude warning supply (Altitude fault)

The flag does not appear if the instrument follows a temperature variation of 50°C/min. For correct channel operation the solenoid is energized by the monitor circuit, the flag is retracted. If a fault occurs in altitude signal transmission, or if the servo loop does not null the CT ISA, the flag appears.

4. Indicator - Angle of Attack and G

A. General

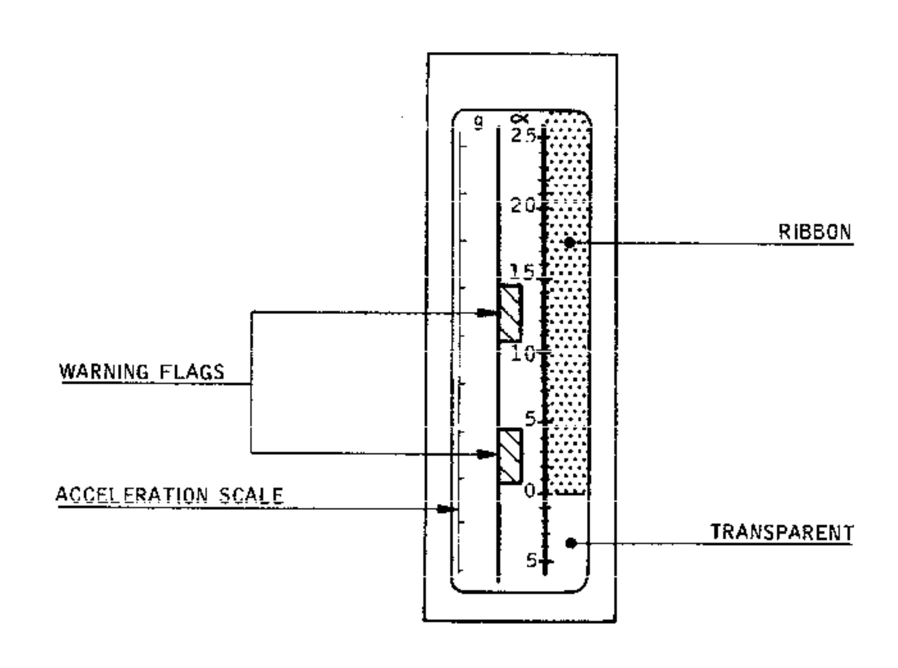
These two independent indicators are contained in a rectangular case. They translate the following information by means of an electro-mechanical system : Angle of attack, acceleration and angle of attack fault warnings. The indicators (1F83 and 2F85) are installed on panels 2-211 and 2-212 respectively.

B. Description

(1) Acceleration Indicator

Ref. Description and Operation, 34-24-00.

(2) Angle of Attack and G Indicator (Ref. Fig. 003)



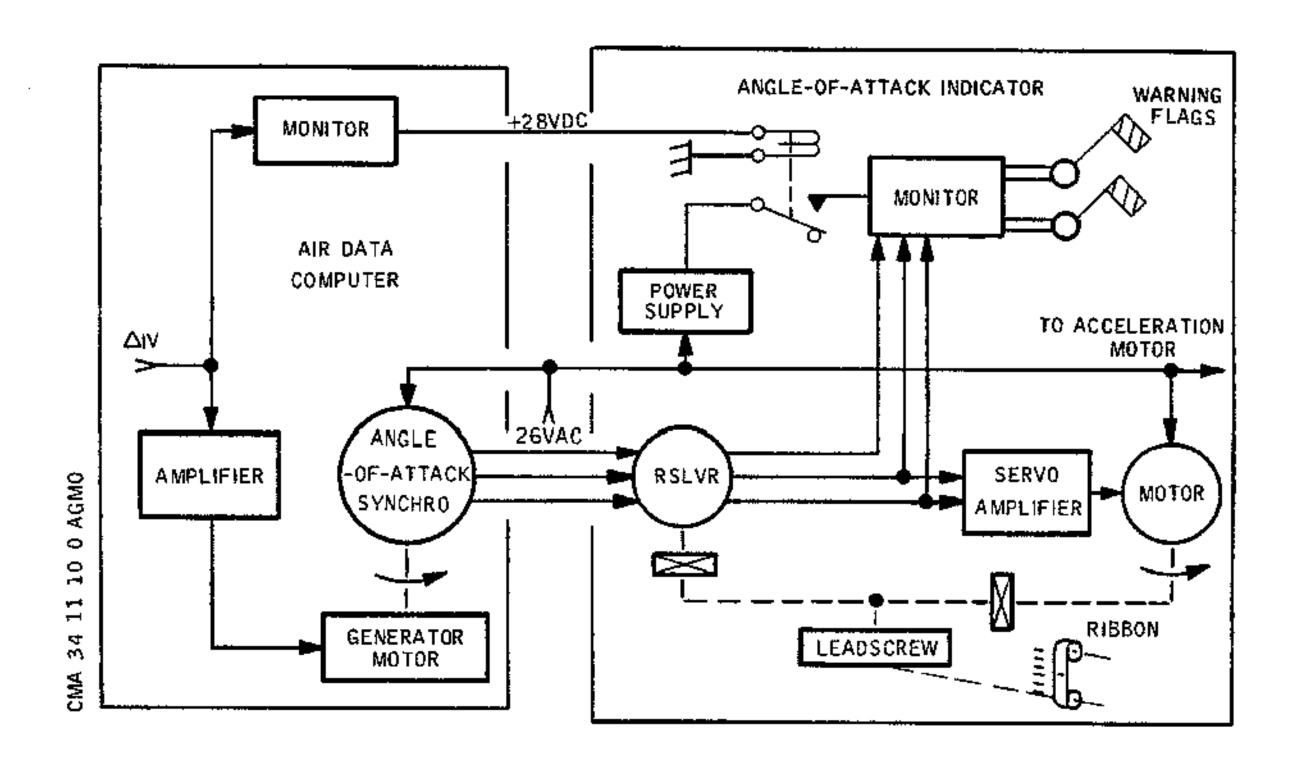
Angle of Attack Indicator Section : Front View
Figure 003

(a) On the face are :

- A ribbon moving along an angle of attack scale, graduated from - 5° to + 25°.
- Two black striped fire orange warning flags indicate an angle of attack or power supply fault.

(b) A common connector at the rear connects the instrument to the external circuits.

C. Operation (Ref. Fig. 004)



Angle of Attack : Indicator Operation
Figure 004

The ADC angle of attack synchro transmits voltage information, proportional to angle of attack, to the instrument synchro resolver, thus producing a misalignment between the synchros. The resultant error signal is applied through a servo amplifier to the servo motor which causes :

- Displacement of the ribbon to enable reading of angle of attack.
- Return to null of the error signal by servo system action.

The ribbon moves along a graduated scale, the upper part of the ribbon is black and is transparent below the point of

indication.

The monitor circuit indicates all faults by means of two warning flags in the following conditions :

- Open circuit between the synchros.
- 26VAC power supply failure.
- ADC angle of attack synchro de-energized.
- Occurrence of a servo error.

The flags do not appear however if the indicator is registering an angle of attack variation greater than 10° per second.

5. Machmeter

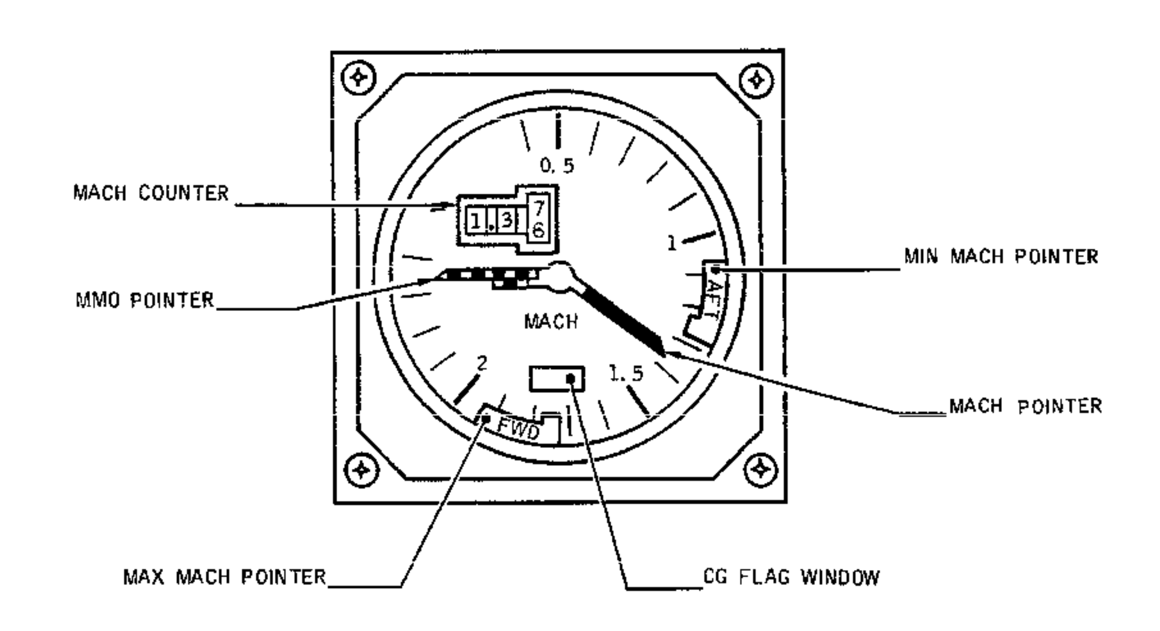
A. General

This instrument indicates :

- Mach number M by repeat of synchro information from an air data computer.
- Mach number MMO by means of voltage information from an air data computer.
- Mach number limits (MAX and MIN) by means of voltage information from a computer.

The indicators (1F80 and 2F80) are installed on panels 2-211 and 2-212 respectively.

B. Description (Ref. Fig. 005)



CMA 34 11 10 0 AJMO

Machmeter : Front View
Figure 005

Instrument face presentation is as follows :

- A dial graduated from mach 0.4 to 2.5.

- A mach counter of which the RH drum is marked in 1/100 mach increments. The LH drum, separated from the center drum by a white decimal point marker, is marked in 1 mach increments. When the monitor system detects a fault a black mask covers the counter drums.
- A white mach pointer which turns through 144° per mach.
- A MMO pointer, checkered arc yellow and black, which turns through 144° per mach.
- Two pointers marked FWD and AFT in black on an arc yellow ground, which turn through 144° per mach.
- A window in which the CG flag appears after detection of a fault by the monitor.
- A fire orange flag on a black ground appears at the lower left of the dial in case of a fault detected by the monitor.

C. Operation (Ref. Fig. 006)

(1) Mach Repetition Channel

(a) Servo Control

The mach signal generated in the air data computer is applied to the input synchro receiver stator windings. The stator produces a magnetic field which varies in direction as a function of the signal. The two windings supply voltages which according to their position with respect to the stator magnetic field. The error signal taken from a winding is applied to an amplifier input. A field effect transistor enables transmission of the error signal during the positive half of the control signal. The phase relationship of the two signals determines the signal polarity at the field effect transistor output. The signal is passed through an amplifier to the motor control stage, the motor drives :

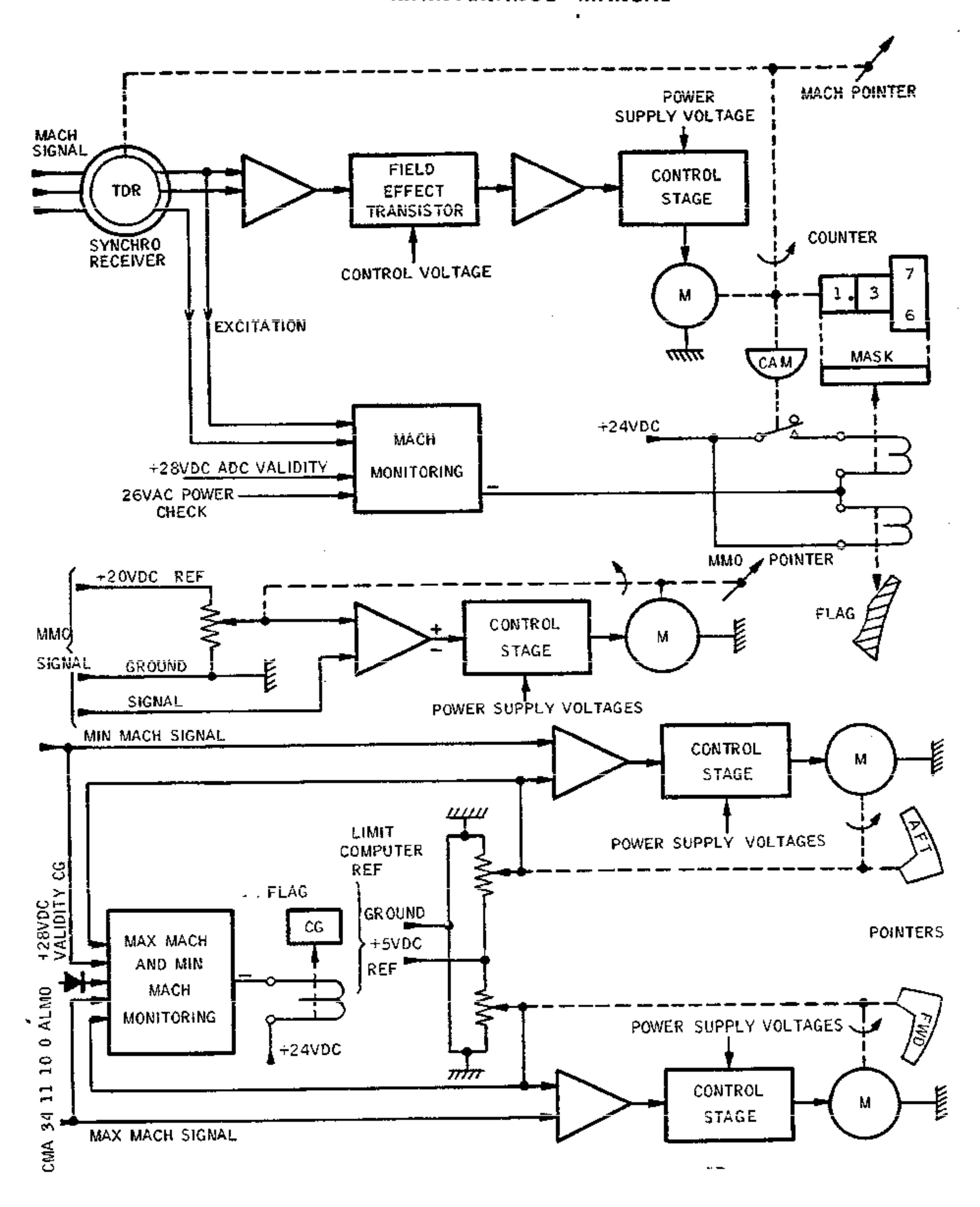
- The mach pointer
- The mach counter
- The cam control of the counter mask
- The input synchro receiver motor.

**ON A/C 001-003,

(b) Monitoring

The monitor system checks :

- The synchro-receiver through the rotor winidngs. These wingings provide the voltages which enable



CMA 34 11 10 0

Machmeter : Operation Block Diagram
Figure 006

checks to be made of the balance condition corresponding to error signal null.
- ADC validity signal + 28VDC.
- 26VAC power supply.

The monitor output provides excitation of the flag solenoids. The excitation is inhibited on detection of a fault, and a diagonally striped flag in orange on a black ground appears.
For a mach number less than 0.45 ± 0.05, or in case of a servo-mechanism defect, a mask covers the counter drums.

After SB 34-007 01 For A/C 001-003,

(b) Monitoring

The monitor system checks :

- The synchro-receiver through the rotor windings. These windings provide the voltages which enable Checks to be made of the balance condition corresponding to the error signal null.
- +28VDC ADC validity signal protected by a diode.
- 26VAC power supply.

The monitor output provides excitation of the flag solenoids. The excitation is inhibited on detection of a fault, and a diagonally striped flag in orange on a black ground appears.
For a mach number less than 0.45 ± 0.05 or in case of a servo-mechanism defect, a mask covers the counter drums.

(2) MMO Repetition Channel

An amplifier repeats MMO information from an air data computer. The positive or negative difference between the two input levels is applied to the motor control stages. The motor drives :

- The MMO pointer.
- The input potentiometer slider.

The servo-loop drives the potentiometer until a null is obtained at the amplifier inputm the motor then stops. The MMO repetition channel is referenced to air data computer ground.

(3) Mach Limits channel (MIN and MAX)

(a) Servo Control

Each pchannel repeats voltage information produced by a computer.
The positive or negative difference at the amplifier inputs is applied to the motor control stage, the motor drive :

- AFT and FWD pointers.
- The potentiometer sliders to obtain a null at the amplifier inputs.

The two mach limits channels are referenced to computer ground.

**ON A/C 001-003,

(b) Monitoring

The monitor system checks :

- The + 28VDC CG validity signal from the computer.
- The input signals of the mach limit amplifiers.

During correct operation the monitor output provides excitation to the flag solenoid. When a fault is detected, the excitation is inhibited, and a fire orange flag labelled CG appears.

R After SB 34-007 01 For A/C 001-003,

(b) Monitoring

The monitor system checks :

- the +28VDC CG validity signal from the computer. The circuit is protected by a diode.
- the input signals of the mach unit amplifiers

During correct operation the monitor output provides excitation to the flag solenoid. When a fault is detected, the excitation is inhibited and a fire orange flag labelled CG appears.

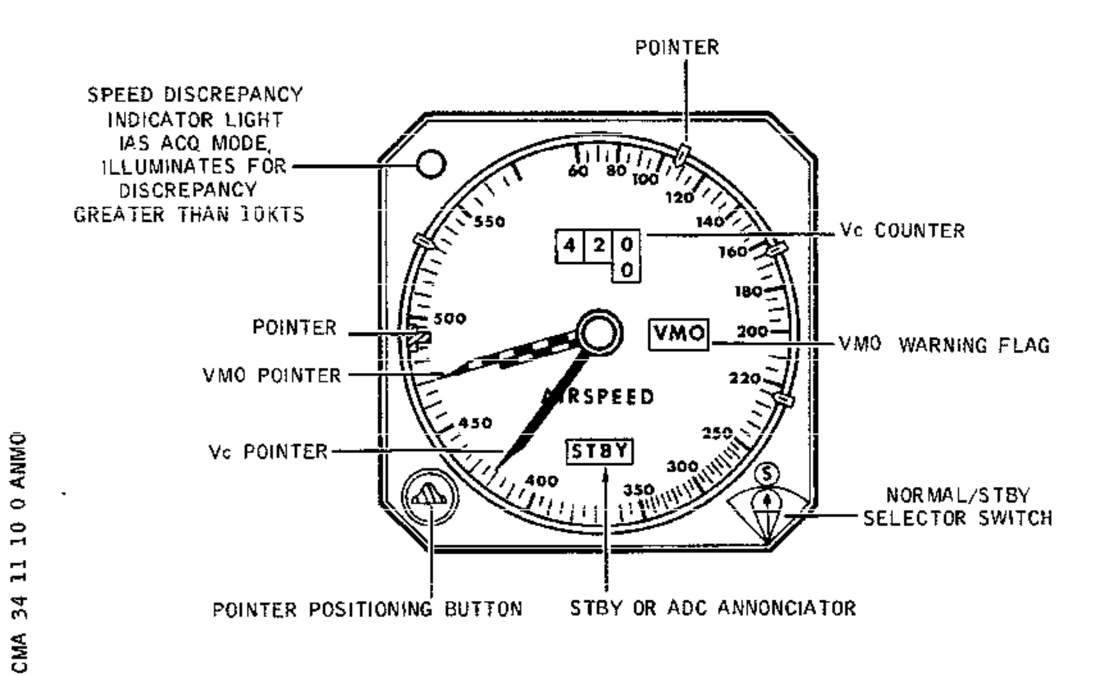
R 6. Indicator-Air Speed

A. General

The airspeed indicator is an instrument with a built-in standby facility which provides speed indications according to NORMAL or STBY mode of operation selected by means of a selector switch on the face.
- In NORMAL mode, the electrical input signal comes from an air data computer.
- In STBY mode, the instrument uses a static and local pressure pneumatic input.

The VMO function signal is independent of the mode selected. The two instruments (1F81 and 2F81) are installed on panels 2-211 and 2-212 respectively.

B. Description (Ref. Fig. 007)



Airspeed Indicator : Front View
Figure 007

Included on the instrument face are :

- a dial graduated from 0 to 570 kts.

- an airspeed counter and a white pointer driven by speed information signals in NORMAL or STBY modes.
  The speed display is masked by the appearance of a black striped fire orange flag when a fault is detected by the monitoring.
- a checkered VMO pointer (black - arc yellow).
- a mode of operation selector knob, NORMAL or STBY. Depending on the selected mode, N or S marker is masked.
- a mode of operation annunciator ADC or STBY, marked in black on an arc yellow ground.
- a VMO warning flag with black letters on a fire orange ground.

R - an index positioning button which positions an arc yellow
R index.
R - four sliding indexes in different colors which are manually positioned around the periphery of the dial. Their
R position is manually adjustable by the pilot. These
R indexes enable setting of flight parameter references.
R (speed of climb, approach, etc). Index colors are not linked to a particular parameter.
- an amber indicator light which illuminates in case of a speed discrepancy greater than 10 kts.

C. Operation (Ref. Fig. 008)

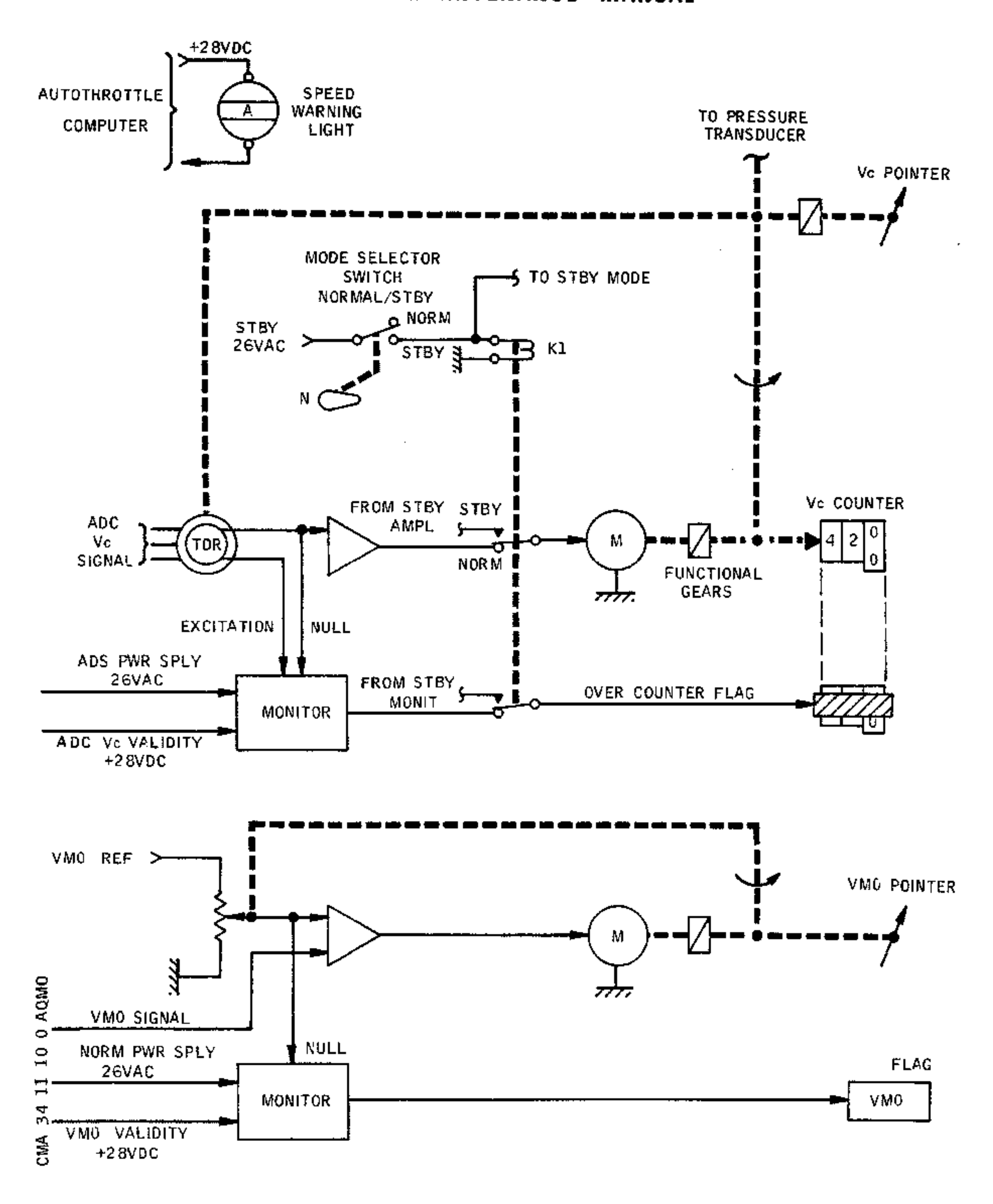
(1) Normal mode

A synchro receiver receives the Vc signal from an air data computer and sends it to the motor control amplifier. With mode selector switch in the NORMAL position, relay K1 is de-energized and connection is made between the amplifier and servo motor, also flag control connection is made.
A gear train controls :
- counter and pointer speed indicators
- the input synchro receiver, to return it to null position
- an electro mechanical transducer connected to an aneroid capsule used in standby mode.

(2) Monitoring

The monitoring system performs the following functions :
- air data computer validity signal monitoring
- 26VAC power supply monitoring
- monitoring of servo error level
- monitoring of presence of the speed signal from the air data computer.

When a fault is detected, a black striped fire orange flag appears before the speed counter, masking the dis-



Airspeed Indicator :
Normal Mode and VMO Operation
Figure 008

play. On switching to standby mode the flag disappears if the mode is operating correctly.

(3) Standby Mode

Ref Description and Operation, 34-13-00.

D. Unit Function (VMO)

(1) Servo Control

The servo control channel repeats the signal transmitted by the air data computer. The motor is controlled by an amplifier which receives :
- reference information from a potentiometer
- the VMO signal.

The potentiometer slider and VMO pointer are driven by a shaft.

(2) Monitoring

The system monitors :
- the validity signal from the air data computer
- the 26VAC power supply
- the servo error level.

If a fault is detected, a fire orange flag marked VMO appears on the right of the dial.

7. Indicator - Vertical Speed

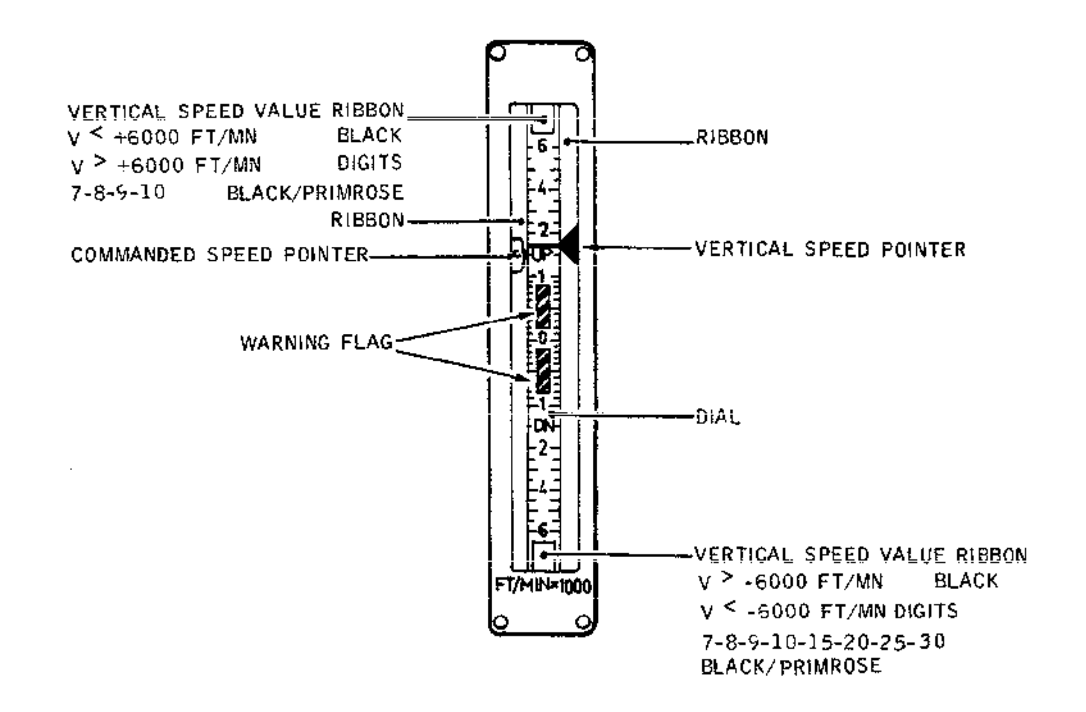
A. General

The servo controlled vertical speed indicator consists of an indicator and an amplifier contained in rectangular cases. The servo controlled vertical speed indicator enables :

R
- Indications by means of two moving pointers, of real vertical speed and commanded vertical speed.
- If necessary, transmission to the automatic pilot of an error signal for production of orders necessary to maintain aircraft commanded vertical speed.
- To give warning indication of a system defect by means of monitoring of the amplifier.

The two instruments (1F85 and 2F85) are installed on panels 2-211 and 2-212 respectively. The amplifiers (1F96 and 2F96) are on shelves 1-215 and 1-216 respectively.

B. Description (Ref. Fig. 009)



Vertical Speed Indicator : Front View
Figure 009

(1) On the Face are :

- A center rectangular window enabling reading of the vertical speeds, real and commanded.
- A real vertical speed pointer, and a commanded vertical speed pointer.
- Two windows in which appear the values beyond the limits of the fixed scale.
- A fault warning flag, red with black stripes, located on either side of the fixed scale zero point.

(2) At the rear is a connector for indicator -amplifier interconnection.

(3) Principle of Operation

The amplifier indicator system operates in NORMAL or COMMAND modes. In NORMAL mode the vertical speed channel produces real aircraft vertical speed indication, the commanded vertical speed channel synchronizes by means of a differential, displacement of pointer C with the vertical speed pointer.

COMMAND mode enables :

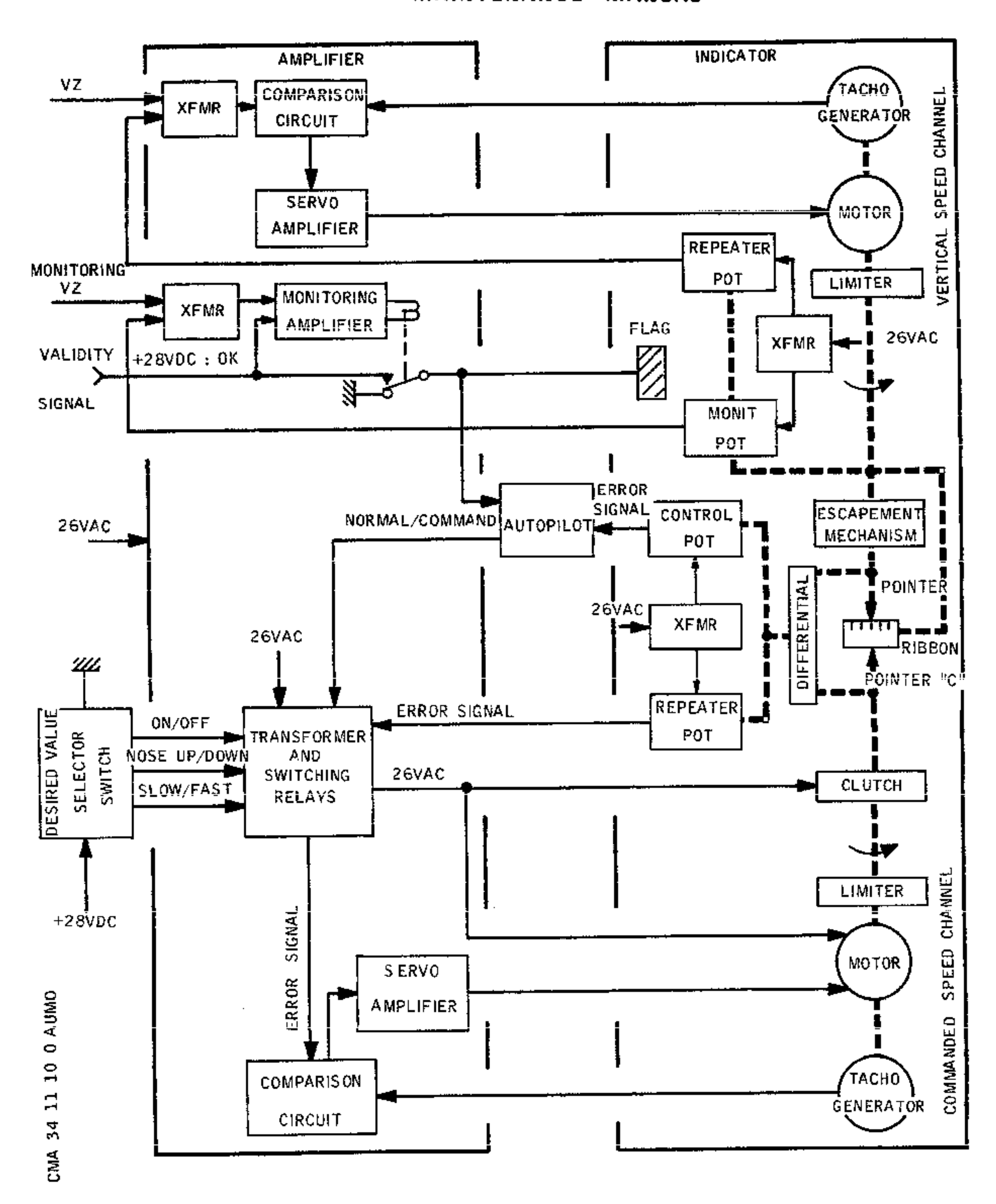
- Holding of commanded speed, Pointer C is locked at a predetermined value, the two channels maintain aircraft vertical speed at the selected value.
- R Selection of a new value. The commanded vertical speed channel, upon selection of a desired vertical speed (climb or descend) produces an error signal which is sent to the automatic pilot, and corrections are sent to the flight controls.
  The ADC supplies a signal which controls the real vertical speed channel. When the two speed values are equal, the two pointers are in alignment.

C. Operation (Ref. Fig. 010)

(1) Vertical Speed Channel

A transformer receives and compares the vertical speed signal Vz with a potentiometer repeater signal. For a null output the channel is inactive : selected vertical speed represents aircraft vertical speed. When this is not the case, the information is compared with that of a tacho generator. The resultant signal is sent to the motor control amplifier. The pointer is positioned by a control linkage.

(2) Commanded Speed Channel



Vertical Speed Indicator : Operation Block Diagram
Figure 010

(a) NORMAL mode

A differential receives information of pointer positions. If the pointers are aligned the repeater potentiometer is at a null with respect to to the pointer and controlled by the differential, does not produce an output and the circuit is inactive.
For a deviation between the pointers, the error signal on the potentiometer is compared with that of the tacho generator. The resultant information is sent to the motor control servo amplifier. Pointer C is aligned with the other pointer.

(b) COMMAND mode

(b1) Vertical speed holding

The COMMAND function controls :

- Declutching of commanded vertical speed channel
- Cut off of 26 VAC motor supply
- Cutting of connection between the repeater potentiometer and amplifier.

Locked pointer C gives a reference position to the differential. Only the vertical speed channel operates. If the two pointers are aligned, the control potentiometer does not send a signal to the automatic pilot and the circuit is inactive. If the pointers are not aligned, the signal sent to the automatic pilot initiates corrections, and enables the ADC to return the vertical speed value to the commanded speed value, bringing the pointers into alignment.

(b2) Selection of a new value

A selector switch transmits to the amplifier the on-off, nose up-down and fast-slow speed functions. According to selection the servo amplifier receives an appropriate motor control signal. The differential and pointer are
R driven at a given speed. This produces a deviation between the pointers. The circuit operates to maintain the commanded vertical speed. When real vertical speed value reaches commanded vertical speed value, the selector switch is returned to the off position.

(3) Monitoring Circuit

The circuit monitors the following parameters :

- Vz monitor signal from the ADC
- The validity signal
- Servo mechanism operation
- AC power supply.

A transformer receives and compares the vertical speed ADC signal, on the signal from the monitor potentiometer, coupled to the repeater potentiometer. In case of a null output the channel is inactive, in case of a signal output the amplifier is activated. The validity signal + 28 VDC disappears and causes :

- Appearance of flags on the indicator.
- Activation of automatic pilot circuit warning.

8. Altimeter

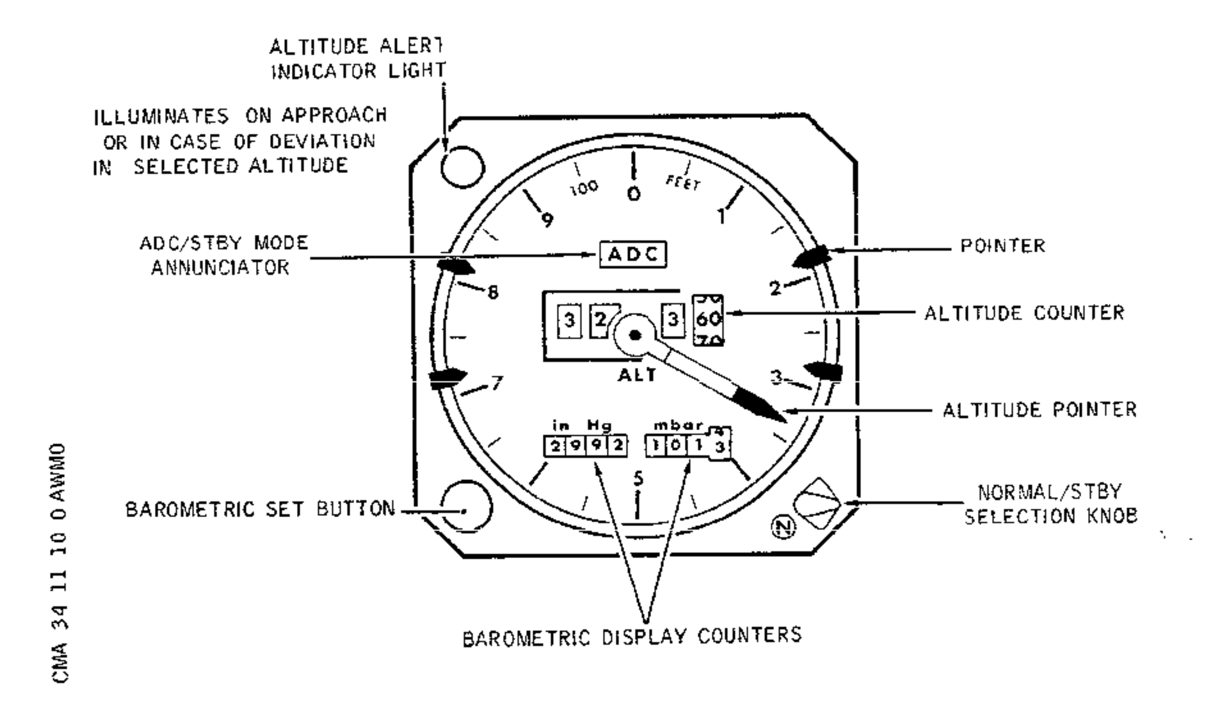
A. General

This instrument, with an incorporated standby facility, supplies altitude indications according to selection of NORMAL or STBY mode, selection is made by means of a selector knob on the face.

- in NORMAL mode the indicator repeats altitude information from an air data computer
- in STBY mode it gives altitude indication from static pressure measurements made by an incorporated transducer.

The two indicators (1F79 and 2F79) are mounted on panels 2-211 and 2-212 respectively.

R B. Description (Ref. Fig. 011)



R Altimeter : Front View
Figure 011

On the face of the instrument are :

- a 360° dial graduated from 0 to 9 in hundreds of feet

- a pointer which makes one turn per 10000 ft. The pointer center and tip are colored white
- a four drum altitude counter, the drums are marked in increments of ten thousand, one thousand, one hundred and
R twenty feet. The twenty feet drum moves in slow steps, the other three drums move rapidly. The RH drum is in increments of twenty feet, the LH drum in 10000 ft increments
- digit 0 on the 10000 ft drum is replaced by a black and white hatched marking which appears for altitudes between 0 and 10000 ft. At negative altitudes, digit 9 on this drum is replaced by white and fire-orange markings, also under these conditions a white and yellow hatched flag appears, which partly masks the upper part of the counter
- in case of a fault, a flag in black and fire-orange hatching appears, and the two flags mask the counter reading
- two barometric counters give display in inches of mercury and millibars
- a black circular button is used for barometric setting
- an altitude alert amber indicator light
- an ADC or STBY mode indicator, in black letters on an arc-yellow ground
- a NORMAL or STBY mode selector switch, an N or S marker appears according to selected mode
- four manually adjustable pointers in various colors, slide round the periphery of the dial.

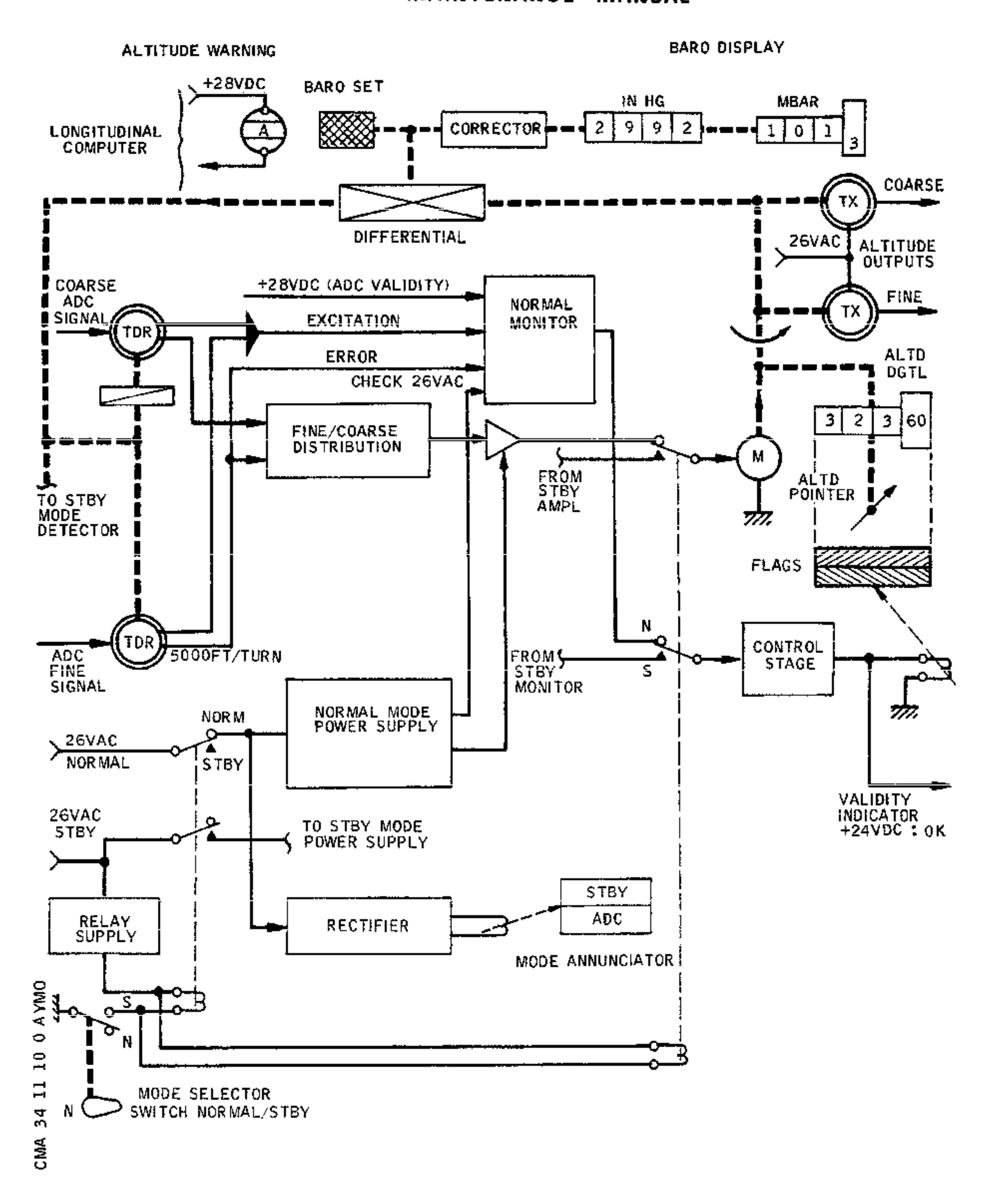
C. Operation (Ref. Fig. 012)

(1) Normal Mode

Two synchro receivers, Fine-Coarse of 1/27 ratio receive altitude information from an air data computer. A FINE/COARSE distribution circuit transmits the error signal to a motor control servo-amplifier. A relay with its contacts in the rest position connects the amplifier to the servo motor and the monitoring circuit to the flag control stage. The motor shaft drives through a gear train :

- the altitude pointer and counter
- the fine and coarse altitude output synchro-transmitters
- error signal null input synchro-receivers
- an electro-mechanical detector, linked to an aneroid capsule in standby mode.

A manual control enables baro-altimetric setting by action on the barometric counters, and by means of a differential on the electro-mechanical altitude display loop.



Altimeter : Normal Mode
Figure 012

(2) Monitoring

The normal mode monitor system ensures :

- check of validity signal from the air data computer
- 26 VAC power supply check
- servo error level check
- check for presence of altitude information from the air data computer.

When a fault is detected, two flags mask the counter diaplay and the indicator validity signal is inhibited.

(3) Standby Mode

Ref. description and operation, chapter 34-13-00.

9. Indicator - True Air Speed (TAS)

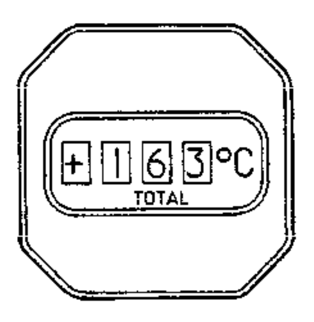
Not applicable

10. Indicator - Total Temperature

A. General

The instrument is contained in a rectangular case. It operates in conjunction with a temperature probe of which the resistance is energized by the instrument. The probe signal is linearised and after conditioning it is converted to digital information by an analog/digital converter. Display of temperature, with its sign, is produced from the digital information by means of 10-position electro-magnetic drums.
The instrument (3F82) is installed on the Flight Engineer panel, on panel 4-214.

B. Description (Ref. Fig. 013)



CMA 34 11 10 0 BEMO

Total Temperature Indicator : Front View
Figure 013

(1) On the Face Appear :

(a) A digital counter, the drums indicating from right to left : units, tens and hundreds of °C.
The LH drum indicates sign, + or -.
For increasing values, the drum digits move from the top downwards.

When the instrument monitoring detects a fault, a black flag with diagonal fire orange stripes masks the drums.

(b) Markings TOTAL and °C

(2) Rear Panel

- A socket for external circuit interconnection.
- A locating pin used in mounting the instrument on the instrument panel.

C. Operation (Ref. Fig. 014)

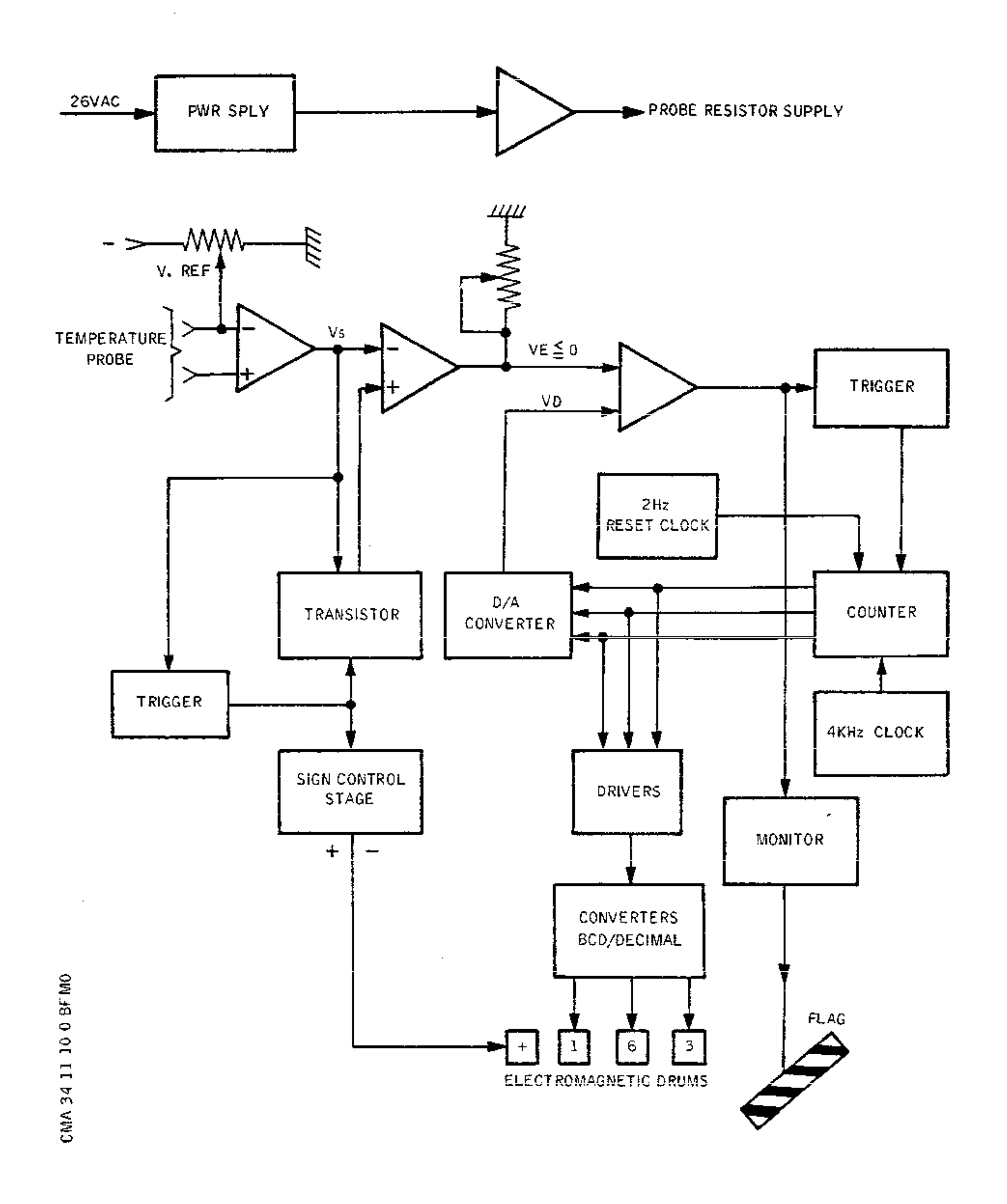
(1) The indicator uses digital techniques : A/D conversion and digital display by means of counters.
The "successive approximation" counter is positioned at the MSB (most significant bit) which is decoded by the D/A converter. The signal obtained is compared with the signal from the input circuit. The result of the comparison determines the storage or cancellation of this bit and the weight to be given to the following bit.
The process is repeated until all the bits have been examined, at this moment the signal from the D/A converter must be equal to the input signal : the temperature is displayed.

(2) Detailed operations

Digital processing and temperature display are achieved by means of the following circuits :
- adapter circuits
- signal processing
- fault detection
- power supply

(a) Adapter circuit

(a1) Probe resistance supply
An operational amplifier (current generator) supplies the probe. The probe generates a
R signal proportional to RT (ohms). Which is sent to the input amplifier of the indicator.



R Total Temperature Digital Indicator, Block Diagram
Figure 014

(a2) Inversion of sign of temperature
For temperatures varying between -50°C to 0°C and 0°C to +50°C, a voltage VE must be obtained equal in absolute value and sign (VE must always be negative).
This requires :
- identical gain for each temperature range
- a polarity inversion system

(a3) Adjustment for T = 0°C
An adjustable reference voltage is applied to the inverting input of the amplifier connected to the probe. The value of this voltage is equal to the probe voltage for a display of 0.
At the differential input, a voltage level of 0V is required to obtain VS = 0.

(a4) Operation for negative temperatures
For temperatures varying between -50° and 0°C an increase of differential voltage is obtained at the amplifier input. The voltage is algebraically added to the reference voltage.
R At the amplifier output, a reduction in positive voltage results, this voltage is applied :
- to the inverting input of an operational amplifier which supplies VE (negative). The slope of VE = f(T) can be adjusted in order to calibrate the display.
- to an operational amplifier connected as a trigger of which the output becames negative. Through the control stages the negative sign is selected.

(a5) Operation for positive temperatures.
In this case an increase in positive voltage is obtained, of which the absolute value is greater than that of the reference voltage.
The output voltage of the operational amplifier becomes positive and causes :
- a transistor to conduct which applies VS to the positive input of the amplifier. This voltage VS is also present at the negative input.
- through the control stages, the plus sign is selected.
Voltage VE is always negative and its slope VE = f(t) is the same for all positive and negative temperatures.

(3) Signal processing

(a) Comparator
A comparator detects all errors in the A/D system by comparing voltage VE with voltage VD from the D/A converter. If the difference is large a flag appears. The amplifier makes a rapid comparison by means of sucessive approximations.
The comparator output voltage is applied to a trigger which supplies a positive or negative voltage according to the result of the comparison.

(b) Measurement system components.
- An amplifier comparator and trigger
- A 12-bit counter operating on the successive approximation principle.
- A 12-bit BCD D/A converter which converts the number contained in the counter to voltage VD.
- A check circuit
- 2 clocks (4 KHz for counter operation and 2 KHz for the measure cycle).

(c) Counter operation
The 2 KHz clock pulses control the counter cycle : reset to zero of all counter stages except the most significant digit of the hundreds decade.
The D/A decoder supplies a voltage VD which corresponds to T = 800°C.
In the two cases, VD greater than VE or VD less than VE, the comparator - trigger system conditions the register command logic and VD assumes a value corresponding to T = 400°C if VD is greater than VE, or T = 1200°C for VD less than VE.
In this way, according to the result of the comparison, a process of sucessive approximations is implemented and VD value tends towards VE.
Successive tests of the 12 register bits require 12 clock pulses at a frequency of 4 KHz. Conse-
R quently the conversion is made in 03 milliseconds.
The calculations are repeated at 0.5 second internals.

(d) Display
The display system consists of :
- adaptor stages
- BCD/Decimal converter, the outputs of which control the display.

(e) Monitoring
A flag masks the drums in case of :
- power supply fault

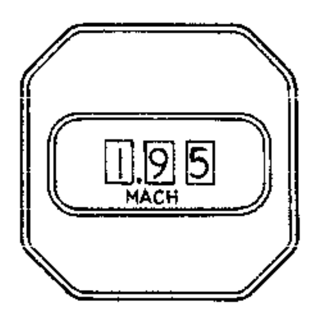
- data processing faults
- open-circuits or short-circuits in the temperature probe wiring.

11. Machmeter-Digital

A. General

The instrument is contained in a rectangular case. It operates in conjunction with an air data computer, which transmits a signal proportional to mach number from a potentiometer. After conditioning, this signal is converted to digital information in an analog/digital converter.
Mach number display is made from the digital information by means of 10-position electro-magnetic drums.
The instrument (3F80) is on the Flight Engineer panel, panel 4-214.

B. Description (Ref. Fig. 015)



CMA 34 11 10 0 BGMO

Digital Machmeter : Front View
Figure 015

R (1) On the face are the following :

(a) A digital counter, the RH drum indicating hundredths of mach.
The center drum, separated from the LH drum by a white decimal point indicates tenths of mach, the LH drum indicates units of mach.
For increasing values, digits on the drums move from the top downwards. A fault annunciator, a black flag with fire orange diagonal stripes, masks the drums when activated by the instrument monitor.

(b) A MACH marking

(2) Rear panel

(a) A plug for interconnection with external circuits.

(b) A locating pin for installation from the front of an instrument panel.

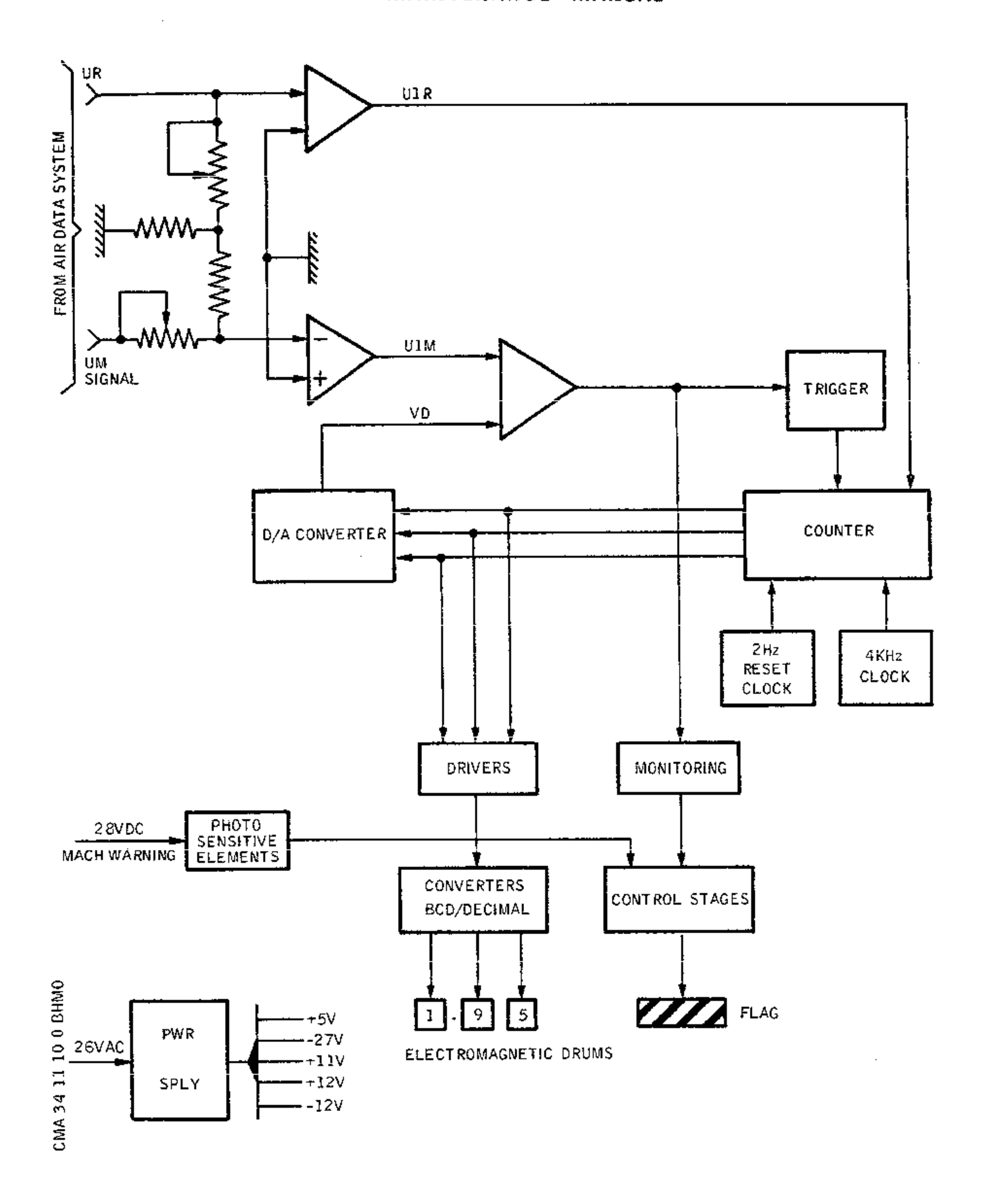
R C. Operation (Ref. Fig. 016)

R (1) Principle
R The machmeter uses digital techniques : A/D conversion
R and digital display by means of counters.
R The successive approximation counter is positioned at
R the MSB (most significant bit) which is decoded by the
R D/A converter. The signal thus obtained is compared
R with the signal from the input circuit. The result of
R the comparison determines storage or cancellation of
R the bit, and the weight to be given to the following
R bit.
R This process is repeated until all the bits in the
R counter have been examined, at this moment the signal
R produced by the D/A converter must be equal to the in-
R put signal : mach number is displayed.

R (2) Detailed operations
R Digital processing and mach number display are achieved
R by the following circuits :
R - Linearity circuit
R - Signal processing
R - Fault warning circuit (warning flag)
R - Power supply

R (a) Linearity circuit

R (a1) Production of reference voltage (V1R)
R An operational amplifier generates the refe-
R rence voltage required for A/D conversion.
R The voltage (VR) comes from a potentiometer



R

Digital Machmeter, Block Diagram
Figure 016

power source in the air data system. The inverter amplifier provides reference voltage (V1R)

(a2) Voltage generator

The voltage generator is an operational amplifier whose input is a voltage from a potentiometer in the air data system. For input of 0 volts, the machmeter must indicate M = 0.25, with an input of 11.47 volts, display corresponds to M = 2.4.

(3) Signal processing

(a) Comparator

An amplifier compares voltage U1M from the input circuit with output voltage VB from the A/D converter. When the conversion is achieved the amplifier output voltage tends to 0. An operational amplifier connected as a trigger, and a stage of the monitor circuit are controlled by this output. The trigger output signal is thus positive or negative according to the result of the comparison.

(b) Measurement system components

- an amplifier - comparator and a trigger
- a 12-bit counter operating on the successive approximation principle
- A 12-bit BCD D/A converter which converts the number contained in the counter to voltage VD
- A check circuit
- 2 clocks (4KHz for counter operation and 2KHz for the measure cycle).

(c) Counter operation

The 2KHz clock output controls the counter cycle : reset to zero of all counter stages except the most significant digit of the hundreds decade. The D/A converter then gives a voltage VD which corresponds to a value mach 8. In both cases, if VD is greater than U1M or VD less than U1M, the comparator trigger system conditions the register command logic, and VD assumes a value corresponding to mach 4 if VD is greater than U1M, or mach 1.2 if VD is less than U1M. In this way, according to the result of the comparison a process of successive approximations is

implemented and VD value tends towards value of U1M.
Successive tests of the 12 register bits require 12 clock pulses at a frequency of 4KHz. Consequently the conversion is made in 3 milliseconds. The calculations are repeated at 0.5 second intervals.

(d) Display
The display system consists of :
- adaptor stages
- BCD decimal converters, the outputs of which control the display on the counter drums.

(e) Monitoring

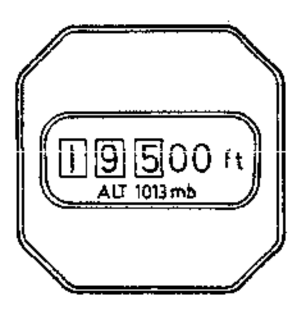
A flag masks the drum in case of :
- 26 VAC power supply fault
- loss of 28 VDC monitor signal (mach warning).
- data processing errors
- loss of reference voltage

12. Altimeter - Digital

A. General

The altimeter is contained in a rectangular case. It operates in conjunction with an air data computer, which produces a signal proportional to altitude from a potentiometer energized by the instrument. After conditioning the signal is converted to digital information in an analog digital converter.
Altitude display is made from the digital information by
R means of 10-position electro-magnetic drums. The instrument (3F79) is on the Flight Engineer panel, on panel 4-214.

B. Description (Ref. Fig. 017)



CMA 34 11 10 0 BJMO

Altimeter - Digital : Front View
Figure 017

(1) On the face are the following :

- ALT. 1013 mb marking
- A digital counter. The two zeros at the right are fixed. The RH drum indicates hundreds of feet and the

center drum thousands of feet (or the - sign for negative altitudes, or a black and white diagonally striped zone for altitudes between 0 and + 10000 ft). For increasing altitudes the drum digits move downwards from the top.

(2) At the rear of the instrument :

- a plug for interconnection with external circuits
- a locating pin, enabling installation from the front of an instrument panel.

R C. Operation (Ref. Fig. 018)

R (1) Principle

R The indicator uses digital techniques : A/D conversion
R and display by means of counters.
R The successive approximation counter is positioned at
R the MSB (most significant bit) which is decoded by the
R D/A converter. The signal thus obtained is compared
R with the signal from the input circuit. The result of
R the comparison determines storage or cancellation of
R this bit and the weight to be given to the following
R bit.
R This process is repeated until all the bits in the
R counter have been examined, at this moment the signal
R produced by the D/A converter must be equal to the in-
R put signal : altitude is displayed.

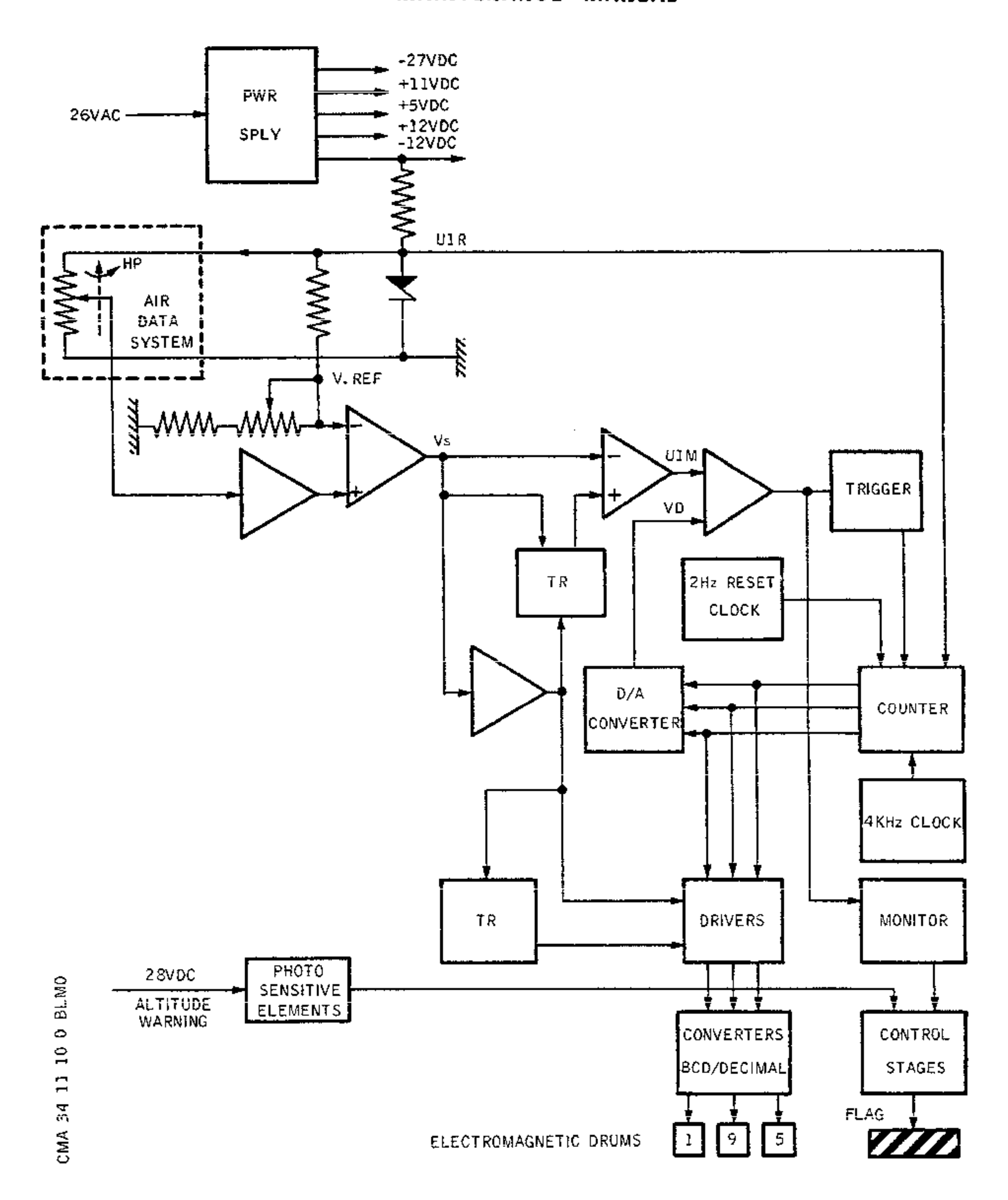
R (2) Detailed operations

R Digital processing and altitude display are achieved
R by the following circuits :
R - linearity circuit
R - signal processing
R - comparator and fault detection circuit
R - power supply.

R (a) Linearity circuit

R (a1) Supply of ADS potentiometer
R This supply is obtained from reference volta-
R ge U1R supplied by the indicator power
R supply. Signal f (Hp) from the potentiometer
R is applied to an adaptor amplifier of which
R the output supplies an operational amplifier.

R (a2) Operation according to altitude
R For altitudes between - 1000 ft and 0ft and
R from 0ft to 65000 ft, a voltage U1M (always



R

Digital Altimeter, Block Diagram
Figure 018

negative) must be obtained. This requires identical gain for the altitude ranges and a polarity inversion system

- altitude 0ft
  This indication is obtained when the reference voltage V ref. (adjustable) is equal to the output of the first amplifier.
- negative altitude.
  For altitudes between - 1000ft and 0ft an increase in negative voltage is produced at the input and output of the first amplifier.
  This voltage is algebraically added to V ref. and at the output of the stage, a reduction of positive voltage is applied :
- to the inverting input of an operational amplifier which gives a decreasing negative voltage (U1M)
- to an operational amplifier connected as a trigger, the output of which becomes negative, blocking the stages which it controls, the minus sign appears on the tens of thousands of ft drum.

- positive altitudes
  In this case, the positive voltage increases to a value greater than the reference voltage. The output of the operational amplifier becomes negative and increases. The trigger output becomes positive and causes :
- R conduction of a stage which applies Vs to the positive input of the amplifier. This voltage is also present at the negative input.
- through a chain of stages, appearance of a striped zone on the tens of thousands of ft drum, if the altitude is less than 10000 ft
  Voltage U1M is always negative and its slope U1M = f(t/p) is the same for positive or negative altitudes.

(3) Signal processing

(a) Comparator
An operational amplifier compares voltage U1M with voltage VD from the output of the D/A converter. When the conversion is made, the amplifier output voltage tends towards 0V.
A trigger and a stage of the fault detection system are controlled by the output. The trigger pro-

vides either a positive or negative output signal depending on the result of the comparison.

(b) Measurement system components
The measurement system consists of :
- an amplifier - comparator and a trigger
- a 12-bit counter operating on the sucessive approximation principle
- a 12-bit BCD D/A converter, which converts the number in the counter to voltage VD.
- a check circuit
- 2 clocks (4 KHz for counter operation and 2 KHz for the measure cycle).

(c) Counter operation

The 2 KHz clock controls the counter cycle : reset to zero of counter stages except the most significant digit of the hundreds decade. The D/A converter then gives voltage VD which corresponds to a digital value of 80,000 ft.
In both cases, if VD is greater than or VD less than U1M, the comparator-trigger system conditions the register command logic, and VD assumes a value corresponding to 40.000ft if VD is greater than U1M, or 12000ft if VD is less than U1M.
In this way, depending on the result of the comparison, a process of successive approximation is
R implemented and VD tends towards value of U1M.
Successive tests of the 12 register bits require 12 clock pulses at a frequency of 4 KHz, consequently the conversion is made in 3 milliseconds.
The calculations are repeated at 0.5 second intervals.

(d) Displays :
The display system consists of :
- adapter stages
- BCD/decimal converters, the outputs of which control the display on the counter drums.

(e) Monitoring
A flag masks the drum in case of :
- power supply fault
- data processing fault
- open-circuit or short-circuit in the potentiometer interconnection
- loss of +28 VDC monitor signal (altitude warning).

13. Cabin Mach Indicators

A. General

The aircraft installation includes two cabin mach indicators, installed in the passenger compartment. One indicator (6F80) is located in zone 221 on galley No. 4 partition and the other (4F80) is located in zone 224 on the centre amenities unit partition. Using ADC data these indicators generate mach information which is presented to the passengers as an electro-luminescent display in the range M 0.28 to M 2.40.

B. Description (Ref. Fig. 019)

(1) Cabin mach indicator, type M2550AA

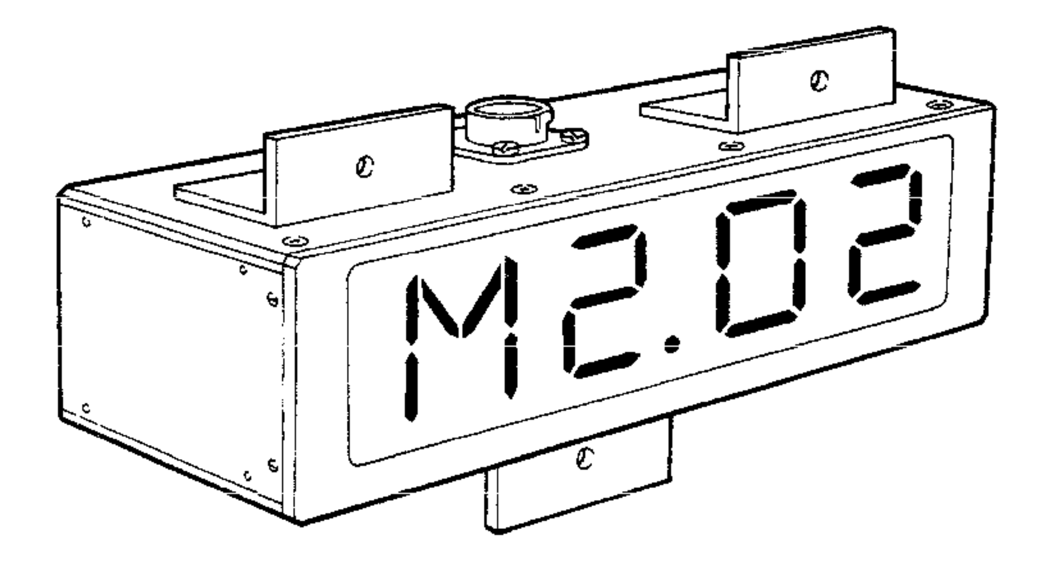
The mach indicator is contained in a rectangular case and weighs 900g (2 lbs). The electronics consists of three printed circuit boards - a power supply, an A/D converter and a display driver.

(a) The face consists of a display which indicates :
- the letter M
- a decimal point
- digits representing units, tenths and hundredths

(b) On the underside of the case there is a connector for connection to the aircraft circuits.

(2) Operation (Ref. Fig. 020)

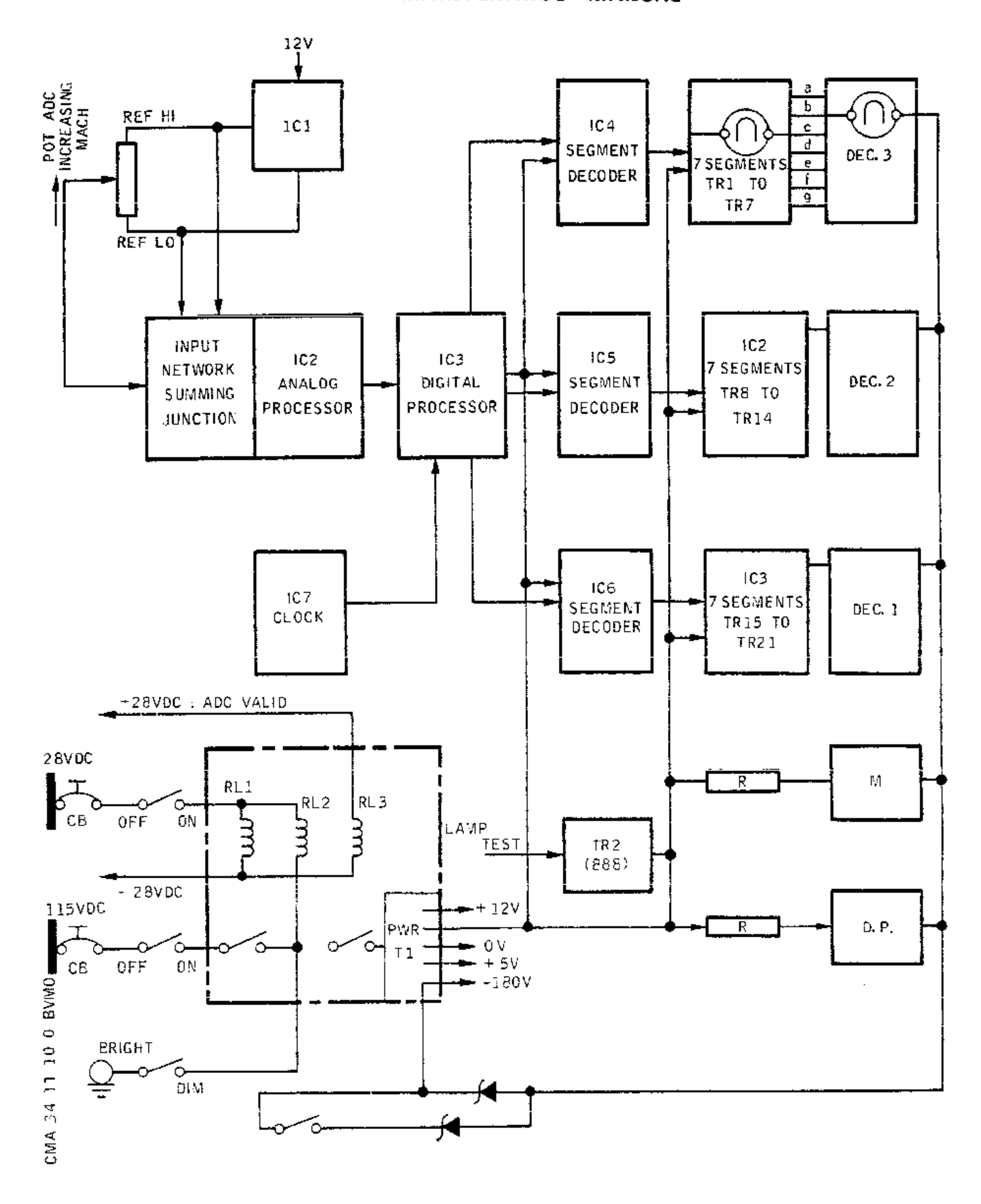
(a) Printed circuit board No. 2 sends a reference voltage to a mach potentiometer in ADC2, the output voltage of which is processed by the input network. Module IC1 provides the reference voltage for the potentiometer, module IC2 and the input network. This circuit produces a time constant of about 1.5 seconds.
The BCD conversion carried out by modules IC2 and IC3 is performed in two intervals : the reference zero is established during the Auto-Zero interval using the input of module IC2. The Measure interval is used to measure the input quantity with respect to the reference zero. The conversion cycle consists of 6144 samples obtained by internal counting using module IC7 ; 2048 samples constitute the Auto-Zero interval and 4096 samples the Measure interval. During the Measure interval the reference zero is maintained. The reference pulses and the ADC signal summed and integrated by the



CMA 34 11 10 0 BTM0

R

Cabin Mach Indicator
Figure 019



Cabin Mach Indicator - Operation Block Diagram
Figure 020

R

R input network determine the duty cycles derived in module IC3. These duty cycles occupy 2 periods of 8 clock pulses ; the sense of the comparator select which duty cycle is applicable.
R In module IC3 the number of clock pulses supplied during the Measure interval is counted, such that the contents will increment for each "high" clock pulse and decrement for each "low" clock pulse.
R After conversion to static latches the output is continually multiplexed to give an output to the display driver via latches IC4, IC5 and IC6.

R (b) Printed circuit board No. 1 comprises the display driver circuits. The outputs of decoder circuits IC1, IC2 and IC3 enable the display segment control transistors. The fixed letter M and the decimal point are connected directly to the display control logic circuit.

R (c) Printed circuit board No. 3 contains the power supply circuit and certain control functions. The transformer receives 115V/400Hz and provides the necessary regulated supplies from 4 secondaries, through bridge rectifiers and integrated circuit regulators. The -180V output is regulated by a transistorised circuit.
R The Night/Day facility provided by relay RL2 is used to dim the display segments.
R In the event of a failure of the ADC valid signal (+28VDC) or the +28VDC supply an inhibit facility cuts off the 115V/400Hz supply via one of the two 28VDC relays (RL1 or RL3).

R

R 14. TCAS VSI

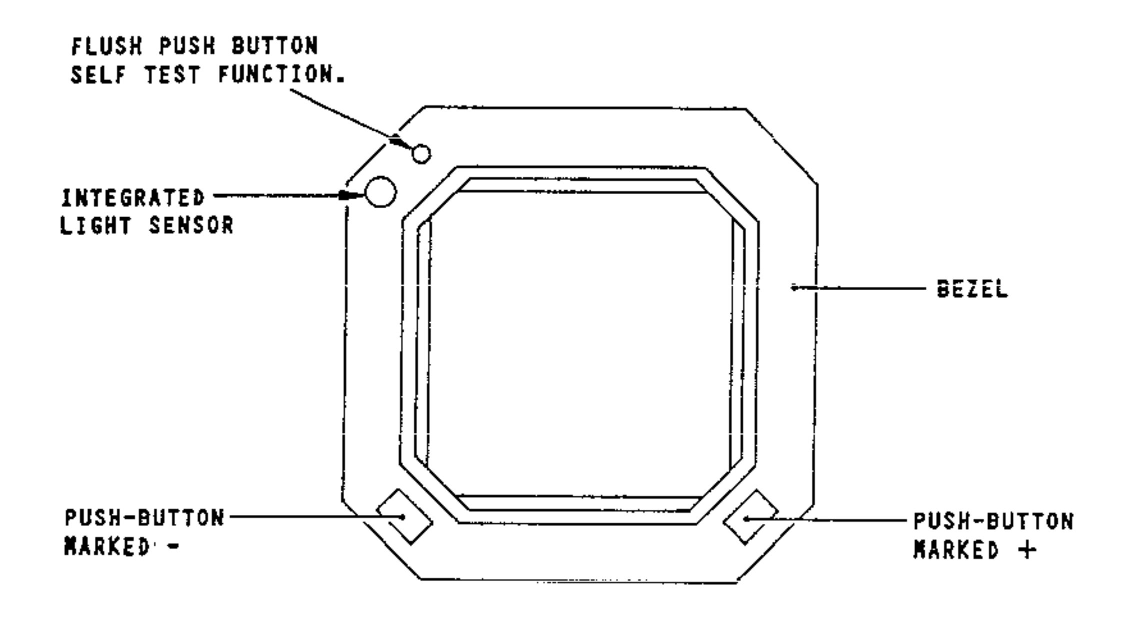
A. General

R The TCAS vertical speed indicator displays:

- Instantaneous vertical speed by means of a pointer and a circular scale.
- TCAS II data:
  - Traffic information (TA mode): coloured symbols and tags displaying intruder positions, altitudes and if the intruder is a potential threat.
  - Resolution orders (RA mode): corrective actions or restricted space to avoid collision. Red and green coloured arcs against the perimeter of the VSI scale indicate the dangerous and safe course change to avoid the intruder.
  - Fault messages and miscellaneous indications.

B. Description

For Description and Operation - Detail (Ref. 34-43-00).



TCAS VSI : Front View
Figure 020

(1) Bezel

The bezel is designed to have minimum occlusion. The viewing angle of 45° is guaranteed at the edge of the visible area.

(2) Integrated Light Sensor

The front face is equipped with an optoelectronic cell which detects the intensity of incident light.

(3) Flush push-button

Can be used to activate the unit self test function.

(4) Bottom left push-button marked - (See Note)

(5) Bottom right push-button marked + (See Note)

NOTE : The push-buttons marked - and + are used to increase or decrease the range (4, 8, 16 NM).

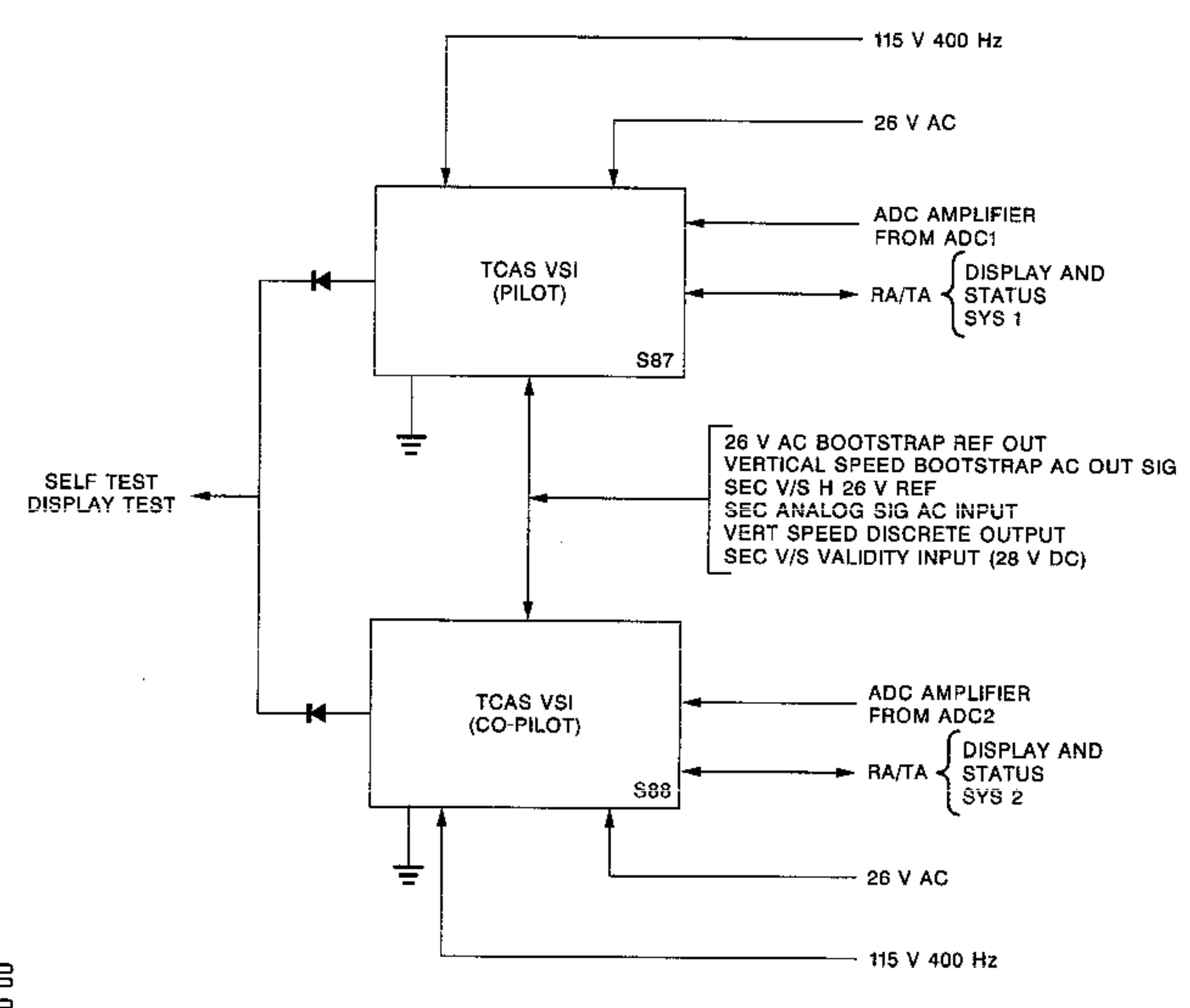
C. Operation

For detail (Ref. 34-43-00)

(1) Principle (Ref. Fig. 021).

(2) Block Diagram (Ref. Fig. 022).

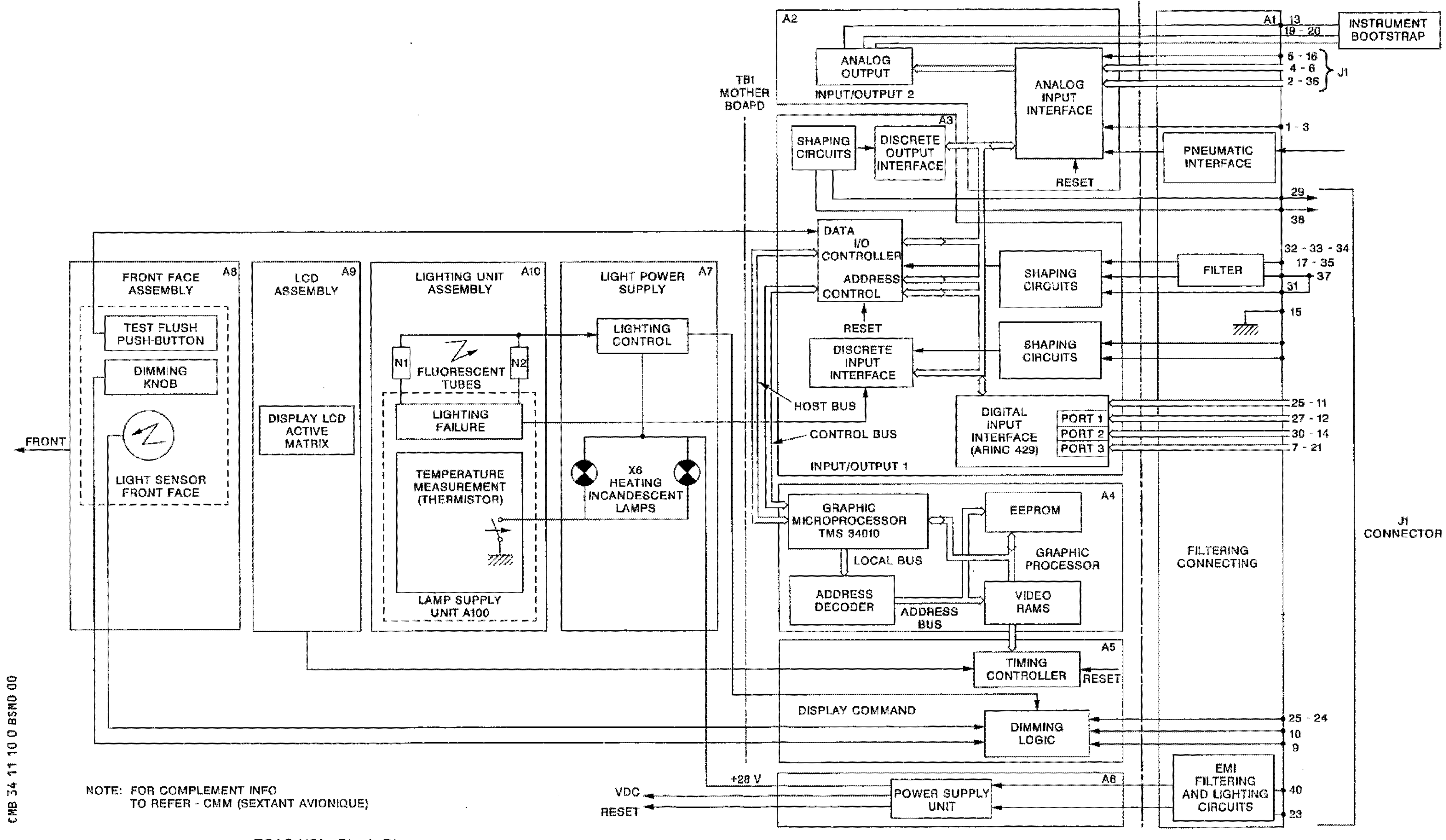
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CMB 34 11 10 0 BUMO 00

R

TCAS VSI - Principle
Figure 021



CMB 34 11 10 0 BSMD 00

R

TCAS VSI - Block Diagram
Figure 022

TEMPERATURE INDICATOR - REMOVAL/INSTALLATION

R

R

1. General

Two indicators are installed, the Captain's instrument is on the First Officer's side of the centre console (7-211) and the other indicator is on panel 15-214 at the 3rd crew member's position.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	-
Blanking Caps for Electrical Connectors	-

B. Prepare

R

R

(1) Place LIGHTING CENTRE CONSOLE rotary switch L383 (panel 4-211) and PANEL LIGHTING rotary switch L385 (panel 11-214) to OFF position.

(2) On centre console 9-211, make certain on ADC control panel that:

(a) ADC1 and ADC2 switches are in OFF position.

(b) TEST selector switches are in NORM position.

(3) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 28V SUP	1-213	1F 74	P12
1ST PLT ADC INST SUP	2-213	1F 75	B 3
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC2 28V SUP	5-213	2F 74	F12
LH DASH INST LTS SUP	13-215	L 372	A12
2ND PLT ADC INST SUP	13-216	2F 75	A14
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 4
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8
3CM STN LM INST LTS SUP	13-216	L 377	E 7

R

R

R

R

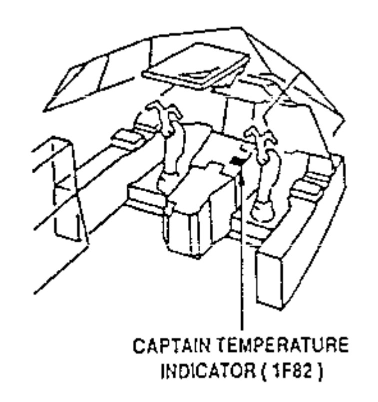
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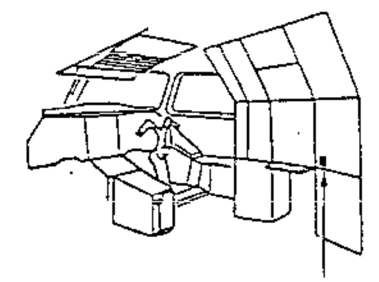
R C. Remove (Ref. Fig. 401)

(1) Loosen and remove the four adaptor plate mounting bolts (4).

(2) Remove adaptor plate (3).

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SEATING
1

REAR
CONNECTOR
2

ADAPTOR
PLATE
3

CONNECTOR
7

INDICATOR
6

MOUNTING
HOLE
5

BOLTS
4

CMA 34 11 11 4 AAMO

Removal/Installation of a Temperature Indicator
Figure 401

R

(3) Carefully remove indicator (6) from its seating (1).

(4) Support and withdraw indicator (6).

(5) Disconnect connector (7) from rear connector (2) of indicator.

(6) Cap connector (7) and rear connector (2).

D. Preparation of Replacement Component

(1) Make certain that indicator seating is clean and that connectors and aircraft wiring are in correct condition.

(2) Make certain that indicator is in correct external condition, that connectors are undamaged and have no traces of corrosion.

R

R

R

R E. Install (Ref. Fig. 401)

(1) Remove blanking caps from connector (7) and rear connector (2).

(2) Connect connector (7) to rear connector (2).

(3) Position indicator (6) facing its seating (1) and carefully install.

(4) Push indicator (6) fully against instrument panel.

(5) Position adaptor plate (3) and install and tighten four mounting bolts (4) in adaptor plate mounting holes (5).

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2.B.(3).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

R
R
R

(4) Adjust LIGHTING CENTRE CONSOLE rotary switch L383 (panel 4-211) and PANEL LIGHTING rotary switch L385 (panel 11-214) to obtain correct illumination of temperature indicator faces.

(5) On centre console 9-211, ADC control panel:

(a) Make certain that test selector switches are in NORM position.

(b) Place ADC1 (ADC2) switch in ON position:

- After approximately thirty seconds press and release amber ADC1 (ADC2) warning light which remains off
- Check on Captain's (First Officer) temperature indicator that warning flags have disappeared

(6) On centre console, ADC control panel place ADC1 (ADC2) test selector switch in MON position:

(a) Amber ADC1 (ADC2) warning lights and blue TEST indicator light on system in operation come on.

(b) On temperature indicator in operation, STATIC and TOTAL flags are not visible.

(7) On panel 1-213, trip circuit breaker STICK SHAKER SUP W513, map. ref. P15.

(8) On centre console 9-211, ADC control panel, place ADC1 (ADC2) system test selector switch in 1 position.

(a) After some seconds blue TEST indicator light on ADC system in operation comes on.

(b) Press and release amber ADC1 (ADC2) warning light which goes off and warning flags disappear on temperature indicator.

(c) On Captain's (First Officer) temperature indicator read following values:

Total temperature (Tt in °C) = +10 ± 2
Static temperature (Ts in °C) = -11 ± 3
ISA temperature (ISA in °C) = -6 ± 3

(9) On centre console 9-211, ADC control panel:

(a) Place test selector switch on ADC system in operation in NORM position, temperature indications return to their initial value and warning flags are visible.

(b) Place ADC1 (ADC2) system switch in OFF position.

G. Close-Up

(1) On panel 1-213, reset STICK SHAKER SUP circuit breaker W513, map ref. P15.

(2) Trip, the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13KS	13-216	X 345	G 4

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

END OF THIS SECTION

NEXT

ANGLE OF ATTACK AND ACCELERATION INDICATOR - REMOVAL/INSTALLATION

1. General

Two angle of attack and acceleration indicators are installed in the aircraft, on the Captain and First Officer instrument panels.
The wiring length :
- is sufficient at the First Officer side to withdraw the instrument directly from the front.
- is insufficient at the Captain side and the indicator is removed after opening a sub-panel.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	

B. Prepare

(1) On Captain panel 12-211 and F/O panel 5-212, make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) On center console 9-211, make certain on ADC control panel that :

(a) ADC1 and ADC2 switches are in OFF position.

(b) TEST selector switches are in NORM position.

(c) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 28V SUP	1-213	1F 74	P12
1ST PLT ADC INST SUP	2-213	1F 75	B 3
1ST PLT ACCELMTR TX SUP		F 36	B 5
ADC1 115V SUP		1F 73	F 3

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC2 28V SUP	5-213	2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
2ND PLT ACCELMTR TX SUP		F 37	D13
ADC2 115V SUP		2F 73	F15
NAV INST BUS 13XS		X 345	G 4

C. Remove (Ref. Fig. 401)

(1) Captain angle of attack and acceleration indicator

(a) On panel 1-211 (sub-panel 1) (1), loosen the two dzus fasteners (8) and release blanking plate (9).

(b) Not applicable.

(c) Loosen and remove the four screws (6), support and release indicator (4) gently from seating (3).

(d) Through opening left by plate (9), disconnect aircraft connector (7) from indicator connector (5).

(e) Withdraw indicator (4).

(f) Cap connectors (5) and (7).

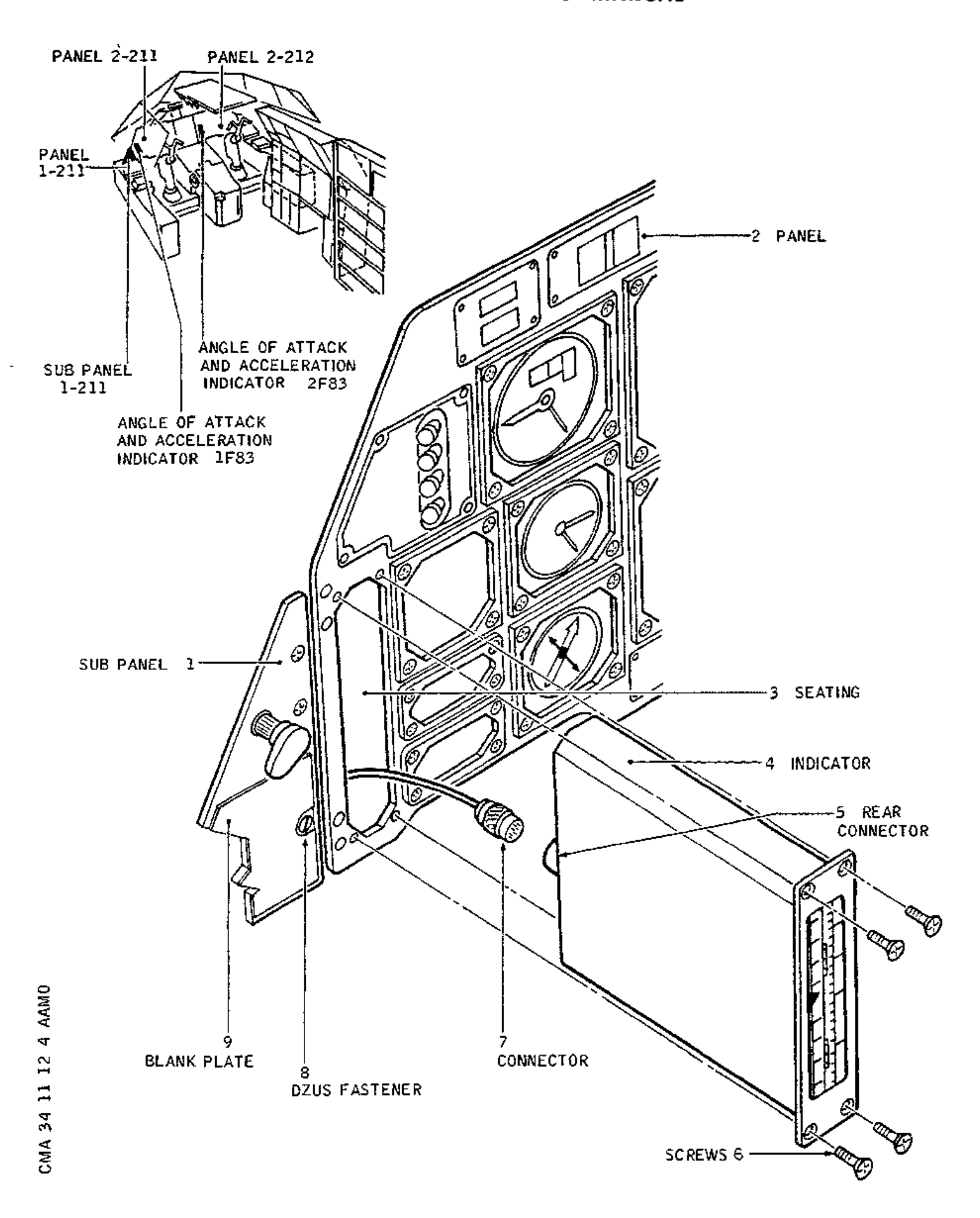
(2) First Officer angle of attack and acceleration indicator

(a) Loosen and remove four screws (6) and withdraw indicator (4) from seating (3).

(b) Disconnect aircraft connector (7) from indicator connector (5).

(c) Cap connectors (7) and (5).

D. Preparation of Replacement Component



Removal/Installation of Angle of Attack and Acceleration Indicator
Figure 401

(1) Make certain that indicator seating is clean and that aircraft connector and wiring are in correct condition.

(2) Make certain that indicator is in correct condition externally and that its connector is not damaged and is free of corrosion.

E. Install
(Ref. Fig. 401)

(1) First Officer angle of attack and acceleration indicator.

(a) Remove blanking caps from connectors (7) and (5).

(b) Position indicator (4) in front of seating and connect aircraft connector (7) to indicator connector (5).

(C) Insert indicator in seating (3), install and tighten four mounting screws (6).

(2) Captain angle of attack and acceleration indicator.

(a) Remove blanking caps from connectors (7) and (5).

(b) Position indicator (4) in front of its seating (3), insert indicator carefully in seating.

(c) Through opening left by plate (9), connect aircraft connector (7) to indicator connector (5).

(d) Push indicator fully against instrument panel (2), install and tighten four mounting screws (6).

(e) Not applicable.

(f) Place blanking plate (9) against sub-panel (1) and lock the two dzus fasteners (8).

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2-B-(3).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) On panels 12-211 and 5-212, adjust LH and RH DASH INSTRUMENTS potentiometers to obtain correct illumination of indicator faces.

(5) On centre console 9-211, on ADC control panel, place ADC1 (ADC2) switch in ON position :

(a) After approximately thirty seconds, press and release amber ADC1 (ADC2) warning light, which remains off.

(b) Check on Captain or First Officer angle of attack and acceleration indicator that the flag is not visible and acceleration indication is 1G ± 0.1.

(6) On centre console 9-211, ADC control panel, place ADC1 (ADC2) system test selector switch in MON position :

(a) Amber ADC1 (ADC2) warning lights and blue TEST indicator lights on system in operation come on.

(b) Flag is visible on angle of attack and acceleration indicator in operation.

(7) On panel 1-213, trip circuit breaker STICK SHAKER SUP W513, Map. Ref. P15.

(8) On centre console 9-211, ADC control panel, place ADC1 (ADC2) system test selector switch in 1 position.

(a) After some seconds blue TEST indicator light on ADC system in operation comes on.

(b) Press and release amber ADC1 (ADC2) warning light which goes off and angle of attack and acceleration indicator flag disappears.

(c) On Captain (F/O) angle of attack indicator, angle of attack reading must be 21.5° ± 0.5.

(9) On centre console 9-211, ADC control panel :

(a) Place ADC1 (ADC2) system test selector switch in NORM position
- angle of attack indication decreases and flag

is visible.

(b) Place ADC1 (ADC2) system test selector in OFF position.

G. Close-Up

(1) On panel 1-213, reset circuit breaker STICK SHAKER SUP W513, Map Ref. P15.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

ALTIMETER - MAINTENANCE PRACTICES

1. Leak Checks

A. A leak check must be performed if :

(1) Any quick release connections in both main pitot/static systems are disturbed, (both systems must be checked).

(2) Any pitot/static connections, other than the quick release type are disturbed in any pitot/static system e.g. Pitot Heads, Static Vents and Drain Taps.

B. No leak check is required if only one pitot and one static quick release connections on only one system are disturbed e.g. a single ADC change.

ALTIMETER - REMOVAL/INSTALLATION

1. General

Two indicators are installed in the aircraft, one on the Captain instrument panel, the other on the First Officer instrument panel. The altimeters are used in NORMAL or STANDBY operation. Because of insufficient wiring length the indicators cannot be withdrawn directly from the front and removal of other instruments is necessary for their removal.
The flexible STATIC line is disconnected at the unions located behind the instrument panels.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps	
Blanking Caps for Air Data System Pressure Lines 'O' Ring Seal	

B. Prepare

(1) On Captain (12-211) and First Officer (5-212) instrument panels, make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) On centre console 9-211, make certain on ADC control panel that :

(a) ADC1 and ADC2 switches are in OFF position.

(b) TEST selector switches are in NORM position.

(3) On altimeter to be removed, place N-S switch in S position.

(4) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 28V SUP	1-213	1F 74	P12
1ST PLT ALT ASI STBY IND	2-213	1F 88	B 1
2ND PLT ALT ASI STBY IND		2F 88	B 2
1ST PLT ADC INST SUP		1F 75	B 3
FLT CONT & NAV BUS 14XS		X 355	H 2
STBY PITOT HTR SUP		H 121	F18
ADC2 28V SUP	5-213	2F 74	F12
LH DASH INST LTS SUP	13-215	L 372	A12
2ND PLT ADC INST SUP	13-216	2F 75	A14
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 4
R SENSOR UNIT 2 SUP		2K2052	B 4

C. Remove of flexible STATIC pressure lines (Ref. Fig. 401)

(1) Static pressure lines at First Officer side.

(a) On First Officer instrument panel (1) remove, without disconnecting, machmeter (2) (Ref. 34-11-14, Removal/Installation).

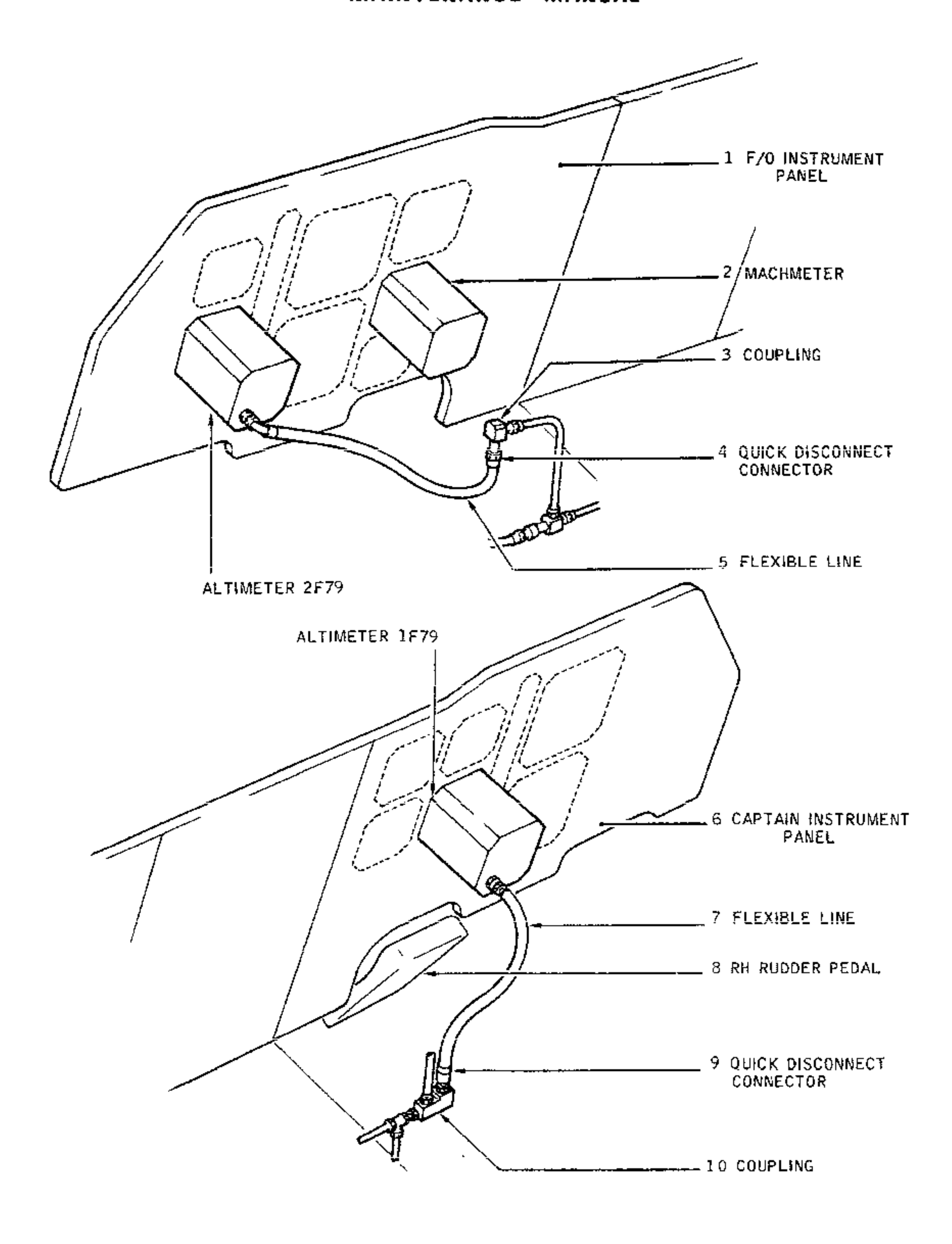
(b) Through machmeter mounting hole, disconnect flexible line (5) from STATIC coupling (3) by means of
R quick disconnect connector (4).

(2) Static pressure lines at Captain side.

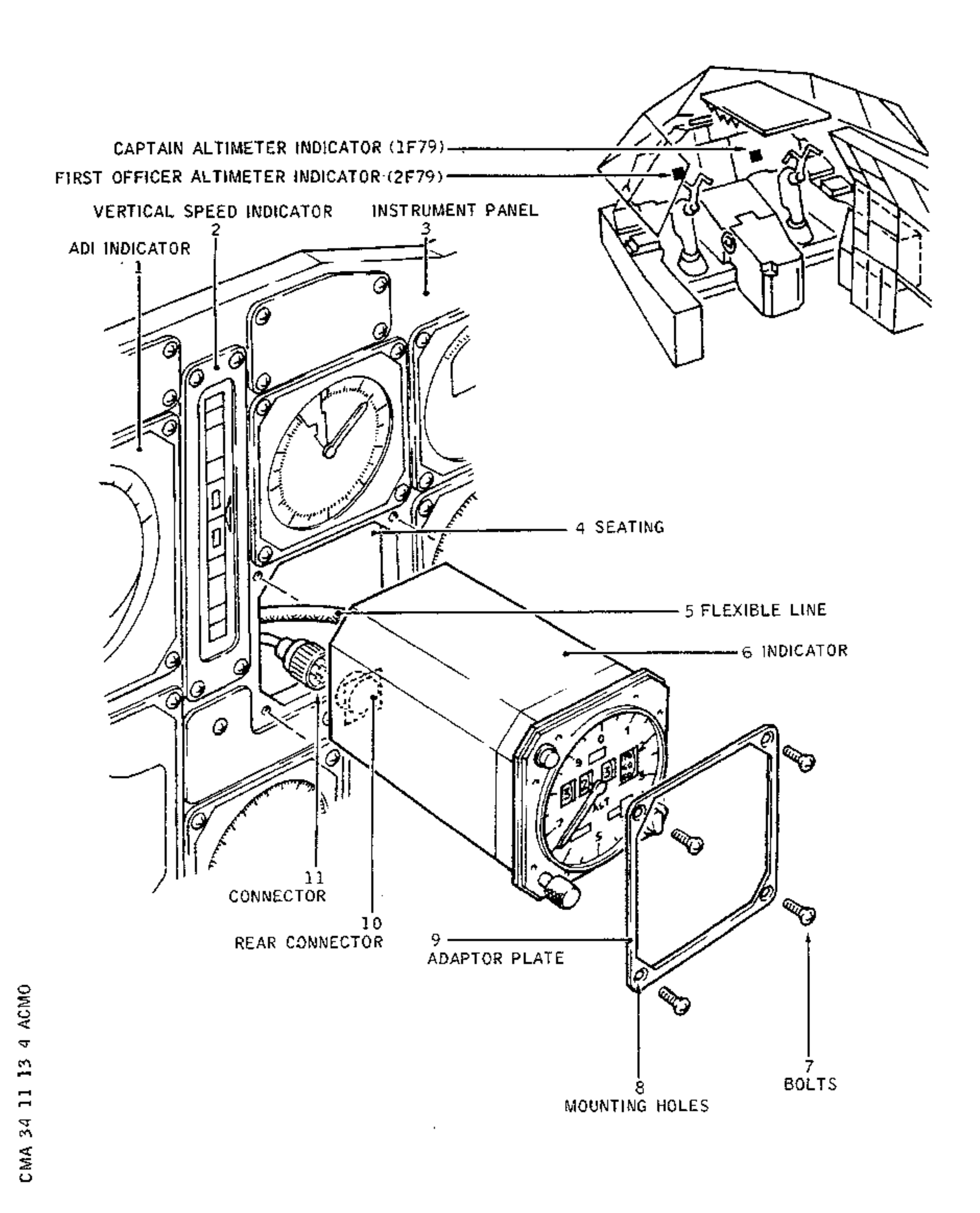
(a) On Captain instrument panel (6) in line with RH rudder pedal (8) disconnect flexible line (7)
R from STATIC coupling (10) by means of quick disconnect connector (9).

D. Removal of altimeter (Ref. Fig. 402)

(1) On Captain or First Officer instrument panel, withdraw, without disconnecting, the ADI indicators (Ref. 34-23-12, Removal/Installation) (1) and vertical speed indicator (Ref. 34-11-16, Removal/Installation) (2).



R Removal/Installation of Flexible STATIC Pressure Line
Figure 401



Removal/Installation of Altimeter
Figure 402

(2) Through ADI indicator mounting hole, disconnect aircraft connector (11) from indicator rear connector (10)

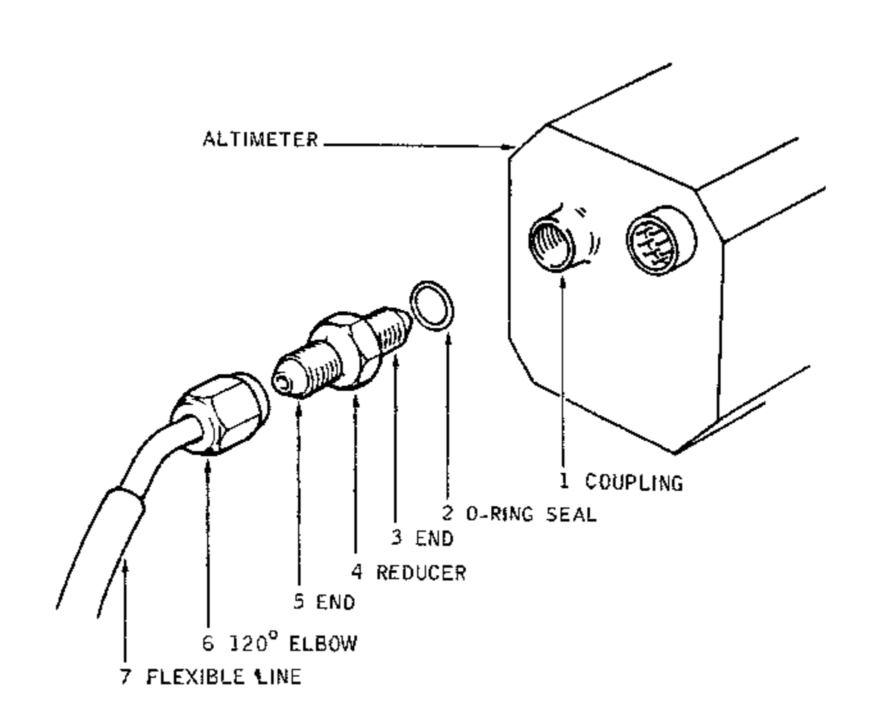
(3) Loosen and remove the four adaptor plate (9) mounting screws (7).

(4) Remove adaptor plate (9).

(5) Remove altimeter (6) from seating (4), then extract by guiding flexible line (5) through ADI seating hole.

(6) Cap static coupling and connectors (10) and (11).

E. Preparation of Replacement Component (Ref. Fig. 403)



R Removal/Installation of Flexible Line to Instrument
Figure 403

(1) Remove reducer (4) from 120° elbow (6).

(2) On removed altimeter, unscrew reducer (4) from instrument union (1).

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(3) Fit blanking caps on :

(a) 120° elbow on flexible line (6).

(b) Ends A (3) and B (5) of reducer (4).

(c) Coupling (1) on indicator.

(4) Make certain that instrument seating is clean and aircraft electrical wiring is in correct condition.

(5) On replacement altimeter :

(a) Make certain that indicator is in correct external condition.

(b) Remove blanking cap from coupling (1).

(6) Remove blanking caps from ends A and B of reducer (4).

(7) Install new 'O' ring seal (2) on end A (3) of reducer (4).

(8) Connect end A of reducer to instrument coupling (1) and torque to between 1.20 and 1.30 m.daN (105 and 115 lbf. in.).

(9) Remove blanking cap from 120° elbow (6).

(10) Connect and tighten flexible line (7) 120° elbow to reducer end B (5).

F. Installation of altimeter
(Ref. Fig. 402)

(1) Remove blanking caps from STATIC coupling and connectors(10) and (11).

(2) Position indicator (6) in front of its seating (4), using ADI seating hole (4) to guide flexible line (5), connect aircraft connector (11) to indicator connector (10).

(3) Install indicator in its seating and push against instrument panel (3).

(4) Position adaptor plate (9), install and tighten 4 mounting screws (7) in adaptor plate mounting holes (8).

(5) On instrument panel, install ADI indicator (1) (Ref. 34-23-12, Removal/Installation) and vertical

speed indicator (2) (Ref. 34-11-16, Removal/Installation).

G. Installation of STATIC flexible pressure line (Ref. Fig. 401)

(1) Static pressure line at Captain side

(a) On Captain instrument panel (6) in line with RH rudder pedal (8), connect flexible line (7) to STATIC coupling (10) by means of quick disconnect connector (9).

(2) Static pressure line at First Officer side.

(a) Through machmeter seating hole, connect flexible line (5) to STATIC coupling (3) by means of quick disconnect connector (4).

(b) On First Officer instrument panel (1), install machmeter (2) (Ref. 34-11-14, Removal/Installation).

R 3. Altimeter 60120-000-1 Removal/Installation Test

R B A. The following tests are to determine the serviceability of the Captain's and First Officers altimeter on installation. These tests do not check the accuracy of the altimeter.

R B B. CAPTS. ALT IF79 STBY. 26V AC 1F88 (2-213)
NORM 26V AC 1F75 (2-213)
F/O's ALT. 2F79 STBY 26V AC 2F88 (2-213)
NORM 26V AC 2F75 (13-216)

R B C. Reset the associated 26V AC STBY, 26V AC Normal circuit breakers. Switch the respective ADC to the "ON" position. Check that the failure flags clear.

R B D. Set the Q.F.E. on the baro-scale and check that the altimeter reads 0±35 feet in the NORM and STBY modes of the altimeter.

R B E. With ADC switched to "ON" and altimeter selected to "NORM" mode check that annunciator shows A.D.C.

R B (1) Switch ADC to "OFF", check that failure flags show. Switch ADC to "ON", check that failure flags clear.

R B (2) Pull 26V AC Normal circuit breaker, check that failure flags show. Reset 26V AC Normal circuit

R B breaker, check that failure flags clear.

R B F. With ADC switch to "OFF" and altimeter selected to "STBY" mode check that annunciator shows STBY.

R B (1) Pull 26V AC Normal circuit breaker. There should be no change in the state of the altimeter.

R B (2) Pull 26V AC STBY circuit breaker, check that failure flags show Reset 26V AC STBY circuit breaker, check that flags clear.

R B G. Set the altitude selector on the Autopilot controller to 1.600 ft. and set the altimeter to 0 feet.

R B (1) Energise the respective altitude alert system and vary the altimeter reading using the baro-set knob until the altitude alert systems generate an audible and visual warning. Check that the amber warning light on the altimeter illuminates. i.e. at 400 feet altimeter reading the 1200 foot alert band should be activated. (This is not a calibration check of the alert system).

R B H. Connect a Bryans leak tester model number 1938 (65-500 kts). or equivalent, to the pitot/static nose probe using adapter part number E21922.

R B (1) Apply a static pressure equivalent to 350 kts. (212.8mb ; 6.28 Hz). The leak rate must not exceed 3 kts over a 3 minute period.

R B (2) During the leak check note the readings of the altimeter and airspeed indicators switched to the standby modes. The readings should be approx. 6.380 ft., 350 kts.

R B (3) Release the static pressure and remove the pitot/ static nose probe test adapter.

R B I. Check operation and presence of the set reminder bugs, 4 OFF.

R B J. Check operation of integral lights. On panels 12-211 and 5-212 adjust LH and RH DASH INSTRUMENTS potentiometers and check that indicator lighting varies.

R B K. Reset altimeter to 0 feet.

R B L. End of check.

MACHMETER - REMOVAL/INSTALLATION

1. General

Two indicators are installed, on the Captain (2-211) and First Officer (2-212) instrument panels. As the wiring length is sufficient, these indicators can be directly removed from the front of the instrument panels.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On Captain and First Officer panels 12-211 and 5-212 make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) On centre console 9-211, make certain on ADC control panel that :

(a) ADC1 and ADC2 switches are in OFF position.

(b) TEST selector switches are in NORM position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 28V SUP	1-213	1F 74	P12
ADC1 26V SUP	2-213	1F 78	A 2
1ST PLT ADC INST SUP		1F 75	B 3
ADC1 115V SUP		1F 73	F 3
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC2 28V SUP	5-213	2F 74	F12

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH DASH INST LTS SUP	13-215	L 372	A12
2ND PLT ADC INST SUP	13-216	2F 75	A14
RH DASH INST LTS SUP		L 371	E 9
ADC2 26V SUP		2F 78	F14
ADC2 115V SUP		2F 73	F15
NAV INST BUS 13X		X 345	G 4

C. Remove (Ref. Fig. 401)

(1) Loosen and remove the four adaptor plate (3) mounting screws (4).

(2) Remove adaptor plate (3).

(3) Carefully release and remove machmeter (2) from its seating (8).

(4) Disconnect aircraft connector (7) from machmeter receptacle (6).

(5) Cap connectors (6) and (7).

D. Preparation of Replacement Component

(1) Make certain that machmeter seating is clean and that connectors and aircraft wiring are in correct condition.

(2) Visually check machmeter for correct external condition, that connectors are undamaged and have no traces of corrosion.

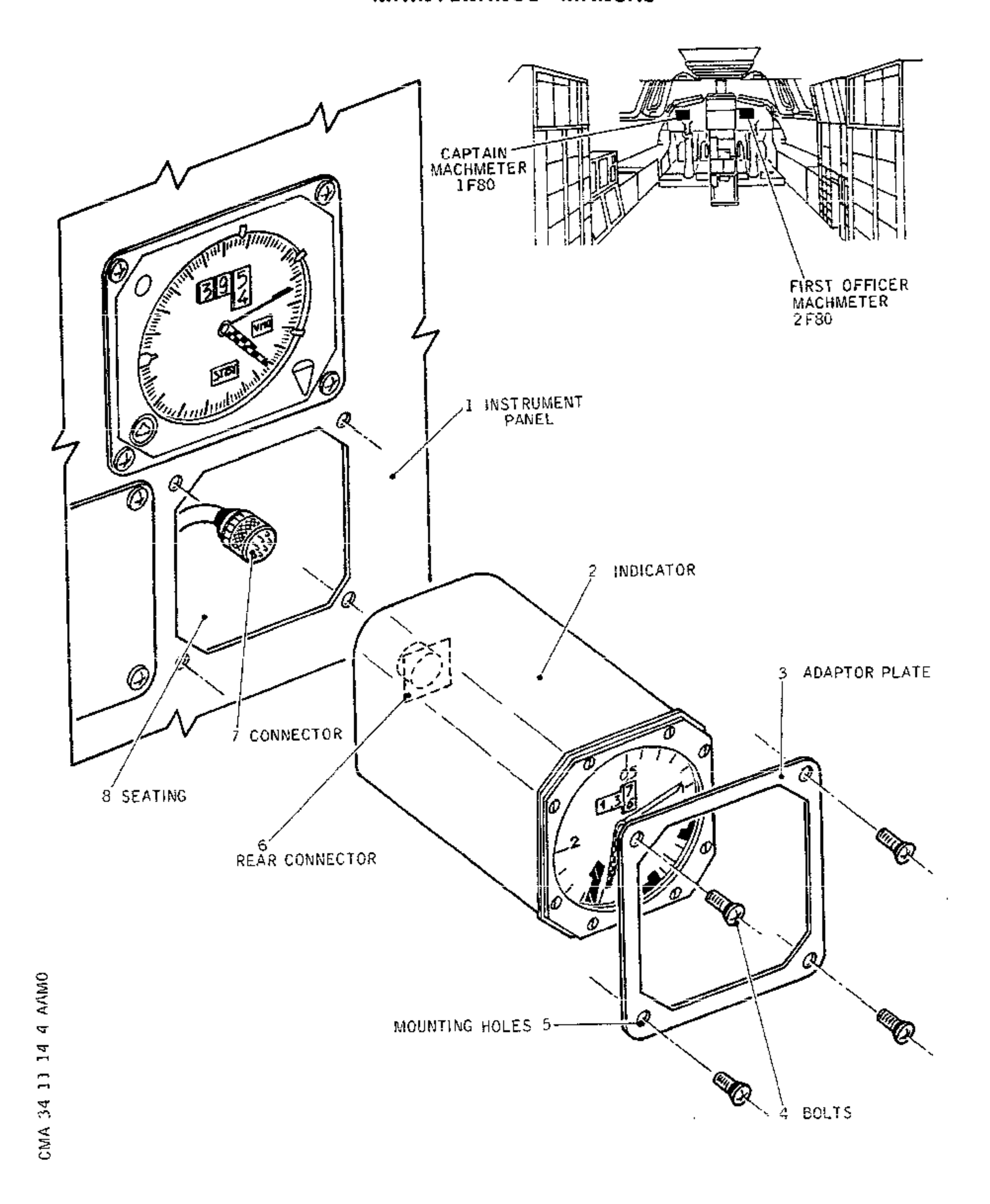
E. Install

(1) Remove blanking caps from connectors (6) and (7).

(2) Position machmeter (2) facing its seating (8), connect aircraft connector (1) to machmeter receptacle (6).

(3) Engage machmeter in its seating and push fully against instrument panel (3).

(4) Position adaptor plate (3) and install and tighten 4 mounting screws (4) in adaptor plate holes (5).



Removal/Installation of a Machmeter
Figure 401

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2-B-(3).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) Adjust LH DASH INSTRUMENTS panel 12-211 or RH DASH INSTRUMENTS panel 5-212 potentiometer to obtain correct illumination of indicator face.

(5) On centre console 9-211, ADC control panel, place ADC1 (ADC2) switch in ON position.

(a) After approximately thirty seconds, press and release amber ADC1 (ADC2) warning light, light remains off.

(b) Check on machmeter that flag is not visible.

(6) On centre console 9-211, ADC control panel, place ADC1 (ADC2) test selector switch in MON position.

(a) Amber ADC1 (ADC2) warning lights and blue TEST indicator light illuminate on system in operation.

(b) Flag is visible on machmeter.

(7) On panel 1-213, trip circuit breaker STICK SHAKER SUP W515, map ref. P15.

(8) On centre console 9-211, ADC control panel, place ADC1 (ADC2) test selector switch in 1 position.

(a) After some seconds, blue TEST indicator light illuminates on ADC system in operation.

(b) Press and release amber ADC1 (ADC2) warning light, light goes off and machmeter flag disappears.

(c) On Captain (First Officer) machmeter, read mach indication which must be 0.63 ± 0.01.

(9) On centre console 9-211, ADC control panel :

(a) Place ADC1 (ADC2) test selector switch in NORM position.
- mach number indication decreases and flag is visible

(b) Place ADC1 (ADC2) test selector switch in OFF position.

G. Close-Up

(1) On panel 1-213, reset circuit breaker STICK SHAKER SUP W513, map ref P15.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

AIRSPEED INDICATOR - MAINTENANCE PRACTICES

1. Leak Check

   A. A leak check must be performed if :

      (1) More than one pitot and one static quick release connection is disturbed in one main system.

      (2) Any quick release connections in both main pitot/static systems are disturbed, (both systems must be leak checked) e.g. interchange of ADC's.

      (3) Any pitot/static connections, other than the quick release type are disturbed in any pitot/static system e.g. Pitot Heads, Static Vents and Drain Taps.

   B. No leak check is required if only one pitot and one static quick release connections on only one system are disturbed e.g. a single ADC change.

R

AIRSPEED INDICATOR - REMOVAL/INSTALLATION

1. General

Two indicators are installed in the aircraft, on the Captain and First Officer instrument panels. The indicators are used in NORMAL or STANDBY operation.
The flexible STATIC and PITOT lines are disconnected at the couplings behind the instrument panels.
As the wiring length is sufficient, the indicators are withdrawn directly from the front.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	
Blanking Plugs for Air Data Lines	
O-Ring Seals	

B. Prepare

(1) On Captain and First Officer panels 12-211 and 5-212, make certain that the LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) On centre console 9-211, make certain on ADC control panel that :

(a) ADC1 and ADC2 switches are in OFF position.

(b) TEST selectors are in NORM position.

(3) On airspeed indicator to be removed, place N-S switch in S position.

(4) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 28V SUP	1-213	1F 74	P12
1ST PLT ALT ASI STBY IND	2-213	1F 88	B 1
2ND PLT ALT ASI STBY IND		2F 88	B 2
1ST PLT ADC INST SUP		1F 75	B 3
FLT CONT & NAV BUS 14XS		X 355	H 2
STBY PITOT HTR SUP		H 121	F18
ADC2 28V SUP	5-213	2F 74	F12
LH DASH INST LTS SUP	13-215	L 372	A12
2ND PLT ADC INST SUP	13-216	2F 75	A14
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 4
SENSOR UNIT 2 SUP		2K2052	B 4

C. Remove STATIC and PITOT Flexible Lines (Ref. Fig. 401)

(1) Air Data Lines at First Officer Side

(a) On First Officer instrument panel (1), in line with LH rudder pedal (8), disconnect for airpeed indicator (2) :

(a1) Flexible static line (7) from static coupler (4) by means of quick disconnect connector (3).

(a2) Flexible pitot line (6) by means of quick disconnect connector (5).

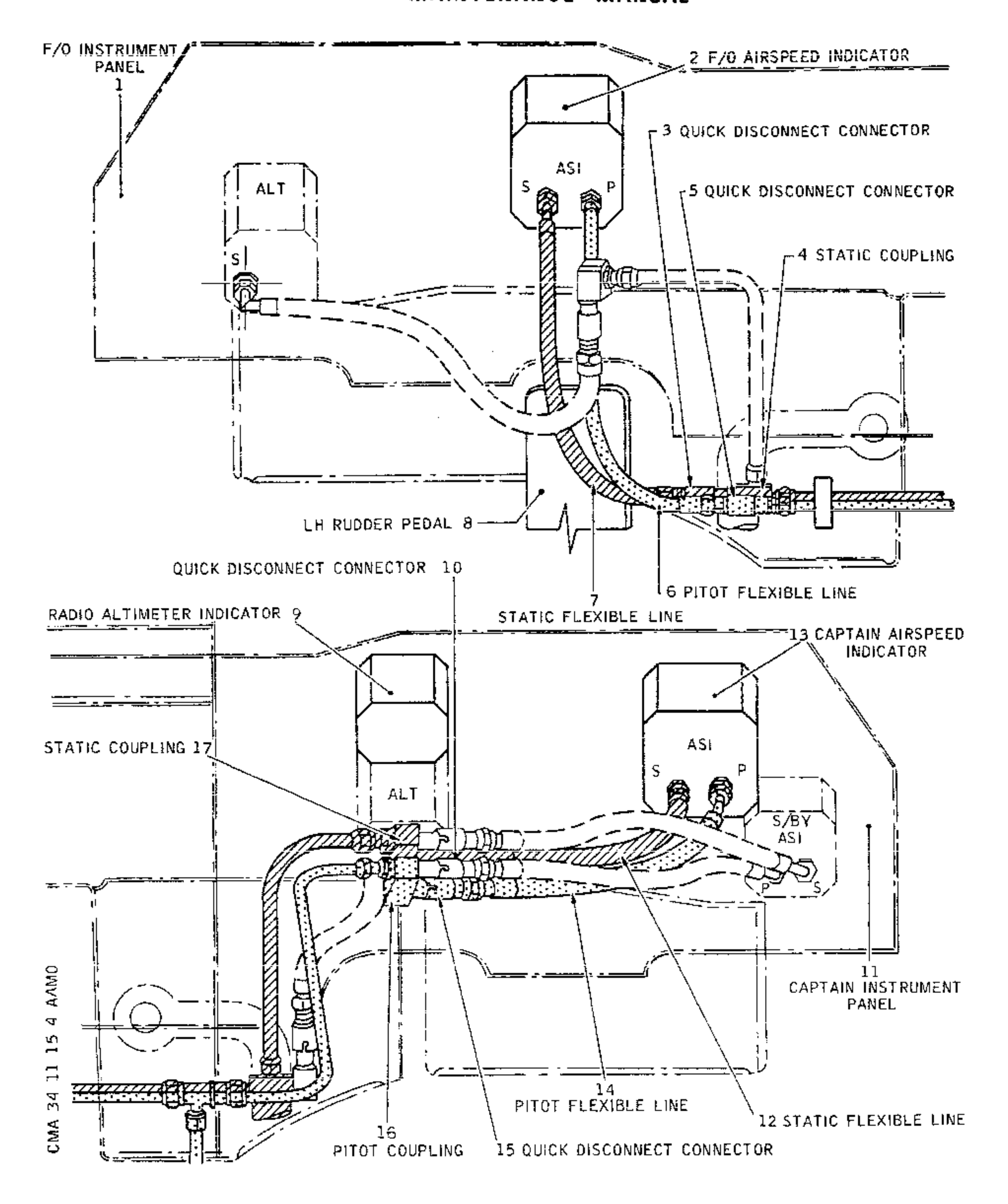
(2) Air Data Lines at Captain side

(a) Captain instrument panel (11), remove radio altimeter indicator (9) (Ref. 34-42-21, Removal/ Installation).

(b) Through radio altimeter housing, disconnect from lower connectors of pressure couplings (16) and (17) for airspeed indicator (13) :

(b1) Flexible static line (12) by means of quick

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Removal/Installation of Static and Pitot Flexible Lines
Figure 401

release connector (10).

(b2) Flexible pitot line (14) by means of quick release connector (15).

D. Remove Captain or First Officer Airspeed Indicator (Ref. Fig. 402)

(1) Instrument panel (1) on airspeed indicator (5) loosen and remove the four attachment screws (6) from adaptor plate (7).

(2) Remove adaptor plate.

(3) Release indicator (5) from its housing (2), withdraw indicator.

(4) Disconnect aircraft plug (4) from indicator receptacle (9).

(5) Completely withdraw indicator, guiding STATIC (3) and PITOT (10) flexible lines.

(6) Cap connectors (4) and (9).

(7) Install blanking plugs on disconnected aircraft air data lines.

E. Preparation of Replacement Component (Ref. Fig. 403)

NOTE : The flexible line unions (6) and (8) are used for :
- Captain indicator, a 135° elbow union for the PITOT line and a straight union for the STATIC line
- First Officer indicator, a 135° elbow union for the STATIC line and a straight union for the PITOT line.

(1) Remove the flexible PITOT line.

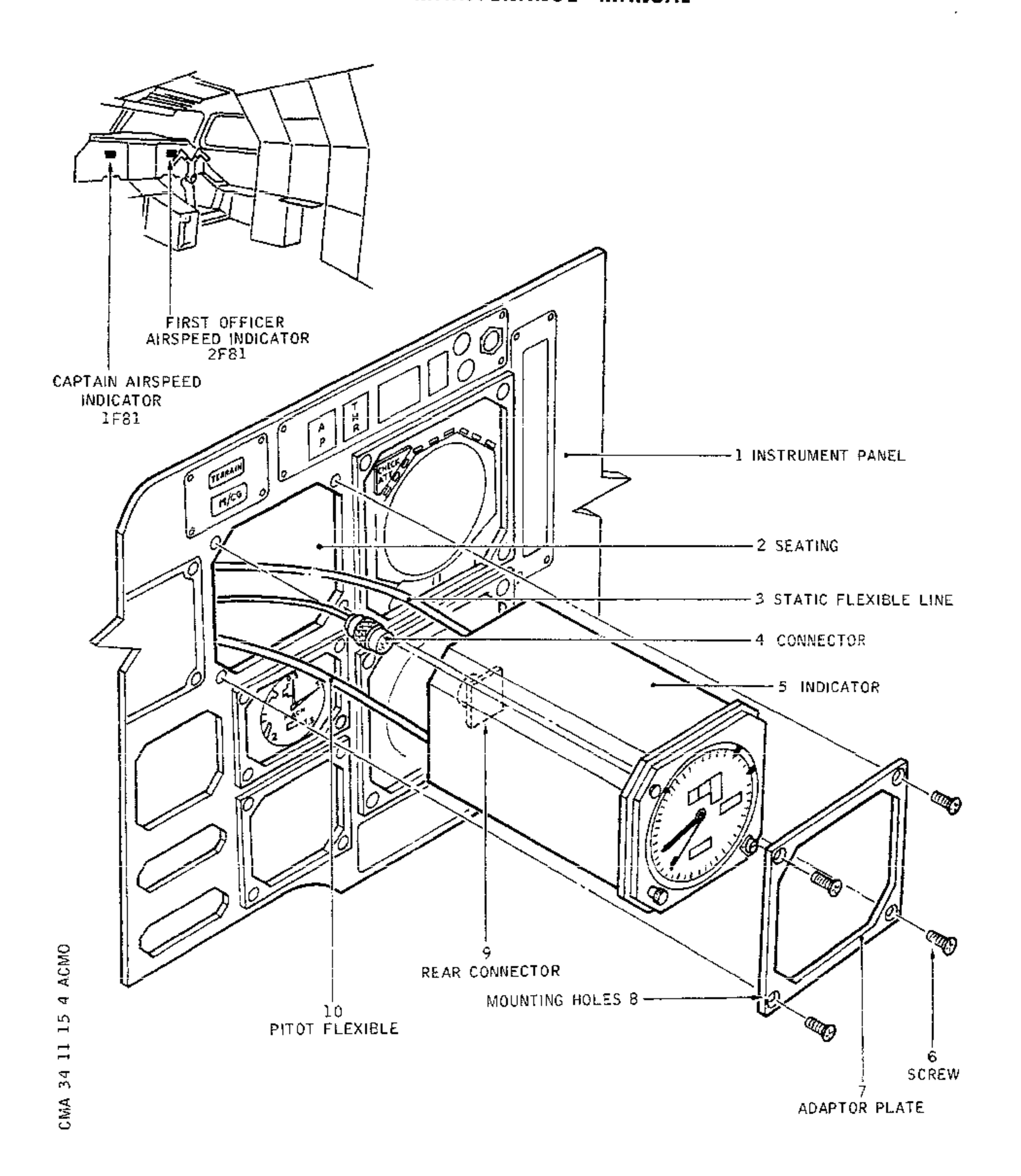
(a) Remove reducer (4) from union (6) or (8) on flexible lines (7). (SEE NOTE).

(b) On airspeed indicator (10) remove reducer (4) from pitot coupling P (1).

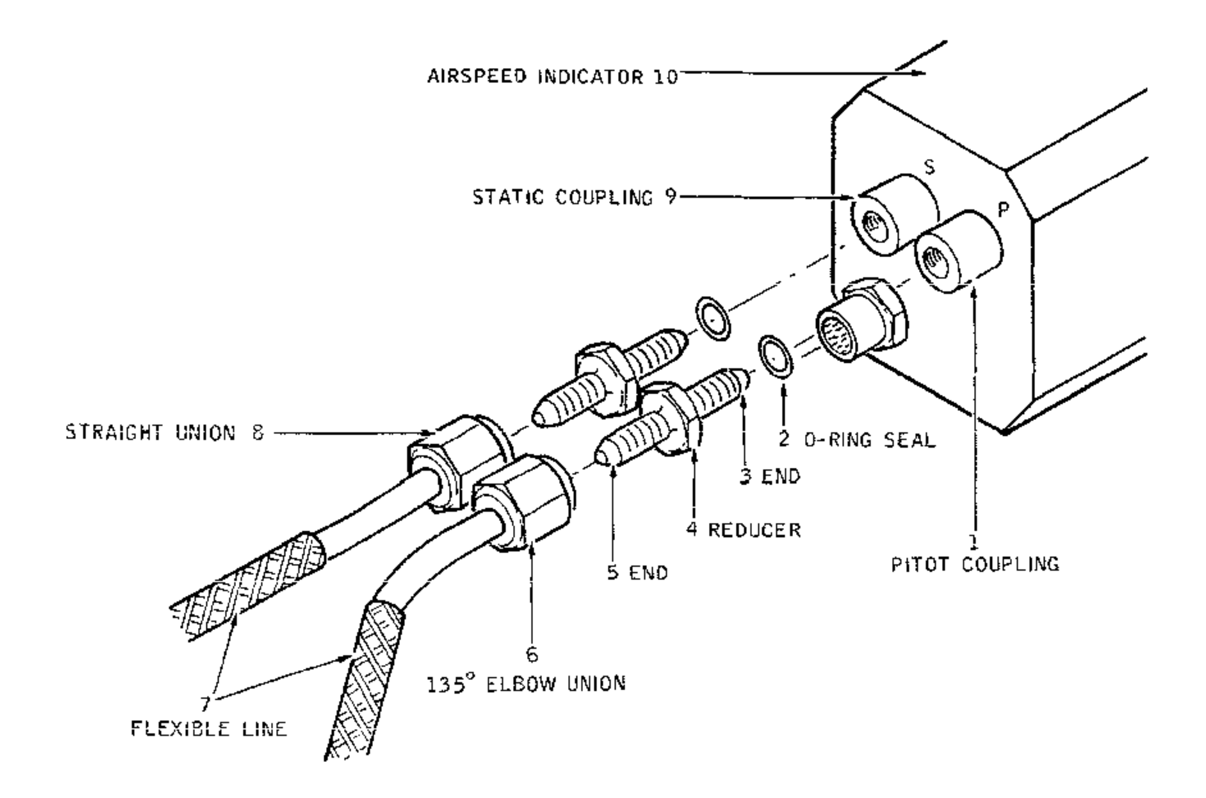
(c) Install blanking plugs on :

(c1) Flexible pitot line union.

(c2) Ends A (5) and B (3) of reducer (4).



Removal/Installation of an Airspeed Indicator
Figure 402



Removal/Installation of Flexible Lines from
Airspeed Indicator
Figure 403

(c3) Coupling P (1) of indicator.

(2) Remove flexible static line.

(a) Remove reducer (4) from union 6 or 8 on flexible line (7). (SEE NOTE).

(b) On airspeed indicator (10) remove reducer (4) from static coupling S (9).

(c) Install blanking plugs on :

(c1) Flexible static line union.

(c2) Ends A (5) and B (3) of reducer (4).

(c3) Indicator coupling S (9).

(3) Make certain that instrument housing is clean and that aircraft electrical wiring is in correct con-

dition.

(4) On replacement airspeed indicator :

(a) Make certain that indicator is in good external condition.

(b) Remove blanking plugs from couplings P (1) and S (9).

(5) Remove blanking plugs from ends A and B of reducer (4)

(6) Install flexible PITOT line.

(a) On end B (3) of reducer (4), install a new O-ring seal (2).

(b) Connect end B of the reducer to pitot coupling P (1) of indicator (10) and torque reducer (4) to between 1.20 and 1.30 m.daN (105 and 115 lbf. in.).

(c) Remove blanking plug from flexible pitot line union.

(d) Connect and tighten union (6) or (8) on flexible pitot line (7) (SEE NOTE) to end A (5) of reducer (4).

(7) Install flexible STATIC line.

(a) On end B (3) of reducer (4), install a new O-ring seal (2).

(b) Connect end B of reducer to static coupling S (9) on indicator (10) and torque reducer (4) to between 1.20 and 1.30 m.daN (105 and 115 lbf. in.).

(c) Remove blanking plug from union on flexible static line.

(d) Connect and tighten union (6) or (8) (See NOTE) on flexible static line (7) to end A (5) of reducer (4).

F. Install Captain or First Officer Airspeed Indicator (Ref. Fig. 402)

(1) Remove blanking plugs from disconnected aircraft air data lines.

(2) Remove blanking caps from connectors (4) and (9).

(3) Position indicator (5) in front of its housing (2) and place flexible STATIC (3) and PITOT (10) lines in housing.

(4) Connect aircraft plug (4) to indicator receptacle (9).

(5) Push indicator fully home in housing on instrument panel (1).

(6) Position adaptor plate (7).

(7) Install and tighten four mounting screws in holes (8) on adaptor plate.

G. Install flexible STATIC and PITOT lines (Ref. Fig. 401)

(1) Air data lines at First Officer side.

(a) On First Officer instrument Panel (1) in line with LH rudder pedal (8), connect for airspeed indicator (2) :

(a1) Pitot flexible line (6) to pitot air data line by means of quick disconnect connector (5).

(a2) Flexible pitot line (7) to static coupling (4) by means of quick disconnect connector (3).

(2) Air Data lines at Captain side

(a) On First Officer instrument panel (11), connect for airspeed indicator (13) through radio altimeter housing (9) :

(a1) Flexible pitot line (14) to lower connector on pitot pressure coupling (16) by means of quick disconnect connector (15).

(a2) Flexible static line (12) to lower connector on static pressure coupling (17) by means of quick disconnect connector (10).

(b) Install radio altimeter indicator (9) (Ref. 34-42-21, Removal/Installation).

H. Close-Up

(1) Perform airspeed indicator test (Ref. 34-11-15, Adjustment/Test).

AIRSPEED INDICATOR - ADJUSTMENT/TEST

1. General

The airspeed indicator is an instrument which supplies airspeed indication in NORMAL or STANDBY operation modes selected by a knob on the front of the indicator.
In NORMAL operation the Captain airspeed indicator operates from data supplied by ADC1, the First Officer airspeed indicator from ADC2 data.
In STANDBY operation the two airspeed indicators indicate airspeed from static and total pressure supplied by the nose probe.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Pressure Generator	
Nose Probe Adaptor	E. 21922
Circuit Breaker Safety Clips	
Access Platform - Height of Access 4.240 m (13ft. 11in.)	

B. Prepare

(1) Remove safety clips and tags and reset the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 28V SUP	1-213	1F 74	P12
1ST PLT ALT ASI STBY IND	2-213	1F 88	B 1
2ND PLT ALT ASI STBY IND		2F 88	B 2
1ST PLT ADC INST SUP		1F 75	B 3
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC2 28V SUP	5-213	2F 74	F12
LH DASH INST LTS SUP	13-215	L 372	A12

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
2ND PLT ADC INST SUP	13-216	2F 75	A14
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 4

(2) Make certain that the following circuit breakers are tripped, safetied and tagged.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STBY PITOT HTR SUP	2-213	H 121	F18
SENSOR UNIT 2 SUP	13-216	2K2052	B 4

(3) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(4) Switch on electronics rack ventilation system (Ref. 21-21-00).

(5) On panels 12-211 and 5-212, adjust LH and RH DASH INSTRUMENTS potentiometers and check that lighting varies on indicators.

(6) On replaced airspeed indicator, select by means of knob in lower RH corner NORMAL mode N, and check that annunciator indicates ADC.

C. Tests

(1) NORMAL mode check

(a) On centre console 9-211, ADC control panel, place ADC1 (ADC2) switch in ON position.

(a1) After approximately 30 seconds, press and release amber ADC1 (ADC2) warning light, which remains off.

(a2) Check an indicator that warning flag is not visible.

(b) On centre console 9-211, ADC control panel, place

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ADC1 (ADC2) system test selector switch on MON position.

(b1) Amber ADC1 (ADC2) warning light and blue TEST indicator light on system in operation come on.

(b2) On airspeed indicator in operation, warning flag is visible.

(c) On panel 1-213, trip STICK SHAKER SUP circuit breaker W513, map ref. P15.

(d) On centre console 9-211, ADC control panel, place ADC1 (ADC2) system test selector switch in 1 position.

(d1) After some seconds, blue TEST indicator light on ADC system in operation comes on.

(d2) Press and release amber ADC1 (ADC2) warning light which goes off, and warning flag disappears on indicator.

(d3) On Captain (F/O) airspeed indicator, read airspeed which must be 350 ± 3kt.

(e) On centre console 9-211, ADC control panel :

(e1) Place ADC1 (ADC2) test selector switch in NORM position. Indicated airspeed decreases and warning flag is visible.

(e2) Place ADC1 (ADC2) system switch in OFF position.

(2) Check in STANDBY mode.

(a) Place access platform under nose probe.

(b) If necessary, remove nose probe protective cover, position nose probe adapter and connect to pressure generator.

(c) On Captain and F/O airspeed indicators and altimeters turn selector knob in lower RH corner to permit letter S to appear and check that annunciator flag on the instruments indicates STBY.

R (d) Start up pressure generator and slowly select :

R (d1) Static pressure (PS) = 300 mb.

R B (d2) Differential pressure (ΔP) = 425.27 mb.

R (e) Check that :

R (e1) Altitude indicated on the altimeters is
R 30050 ± 250ft.

R (e2) Airspeed indicated on airspeed indicators is
R B 480 ± 3kt.

(f) Isolate air data system from pressure generator and after 10-minutes make certain that on the Captain and F/O airspeed indicators and Captain airspeed/mach indicator indicated airspeed deviation does not exceed 3kt.

(g) On pressure generator, slowly return pressure controls (PS and ΔP) to normal pressure.

D. Close-Up

(1) Open standby air data system to ambient air, check on airspeed indicators, altimeters and airspeed/mach indicator that readings return to initial values.

(2) On Captain and F/O airspeed indicators and altimeters, place mode selector in N position.

(3) Remove adaptor from nose probe and install protective cover.

(4) Remove access platform from nose probe and remove pressure generator.

(5) Switch off electronics rack ventilation system (Ref. 21-21-00).

(6) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(7) Remove safety clips and tags and reset the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STICK SHAKER SUP	1-213	W 513	P15
STBY PITOT HTR SUP	2-213	H 121	F18
SENSOR UNIT 2 SUP	13-216	2K2052	B 4

(8) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

VERTICAL SPEED INDICATOR - REMOVAL/INSTALLATION

1. General

Two indicators are installed, on the Captain and First Officer instrument panels. Because of insufficient wiring length, the, connectors of these indicators shall be disconnected after removing the relevant glareshield panel, after which the indicator shall be withdrawn from the front.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On LH and RH side panels 12-211 and 5-212 make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) On centre console 9-211, make certain on ADC control panel that :

(a) ADC1 and ADC2 switches are in OFF position.

(b) TEST selector switches are in NORM position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 28V SUP	1-213	1F 74	P12
AP/FD SYS 1 CONT		1C 17	Q13
1ST PLT VSI SUP	2-213	1F 97	A 3
FLT CONT & NAV BUS 14XS		X 355	H 2
AP/FD SYS 2 CONT	5-213	2C 17	A11
ADC2 28V SUP		2F 74	F12

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH DASH INST LTS SUP	13-215	L 372	A12
2ND PLT VSI SUP	13-216	2F 97	B13
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		x 345	G 4

C. Remove (Ref. Fig. 401)

(1) On Captain or First Officer instrument panel (2) release dzus fasteners (9) attaching glareshield panel (1).

(2) Lift glareshield panel (1) partially, then gain access under glareshield panel and disconnect aircraft connectors (8) from rear connector (7) on indicator (4).

(3) Loosen and remove from mounting screws (5) and remove vertical speed indicator (4) from seating (3).

(4) Cap connectors (7) and (8).

D. Preparation of Replacement Component

(1) Make certain that indicator housing is clean and that aircraft wiring and connectors are in good condition.

(2) Make certain that indicator is in good external condition and that its connectors are undamaged and have no trace of corrosion.

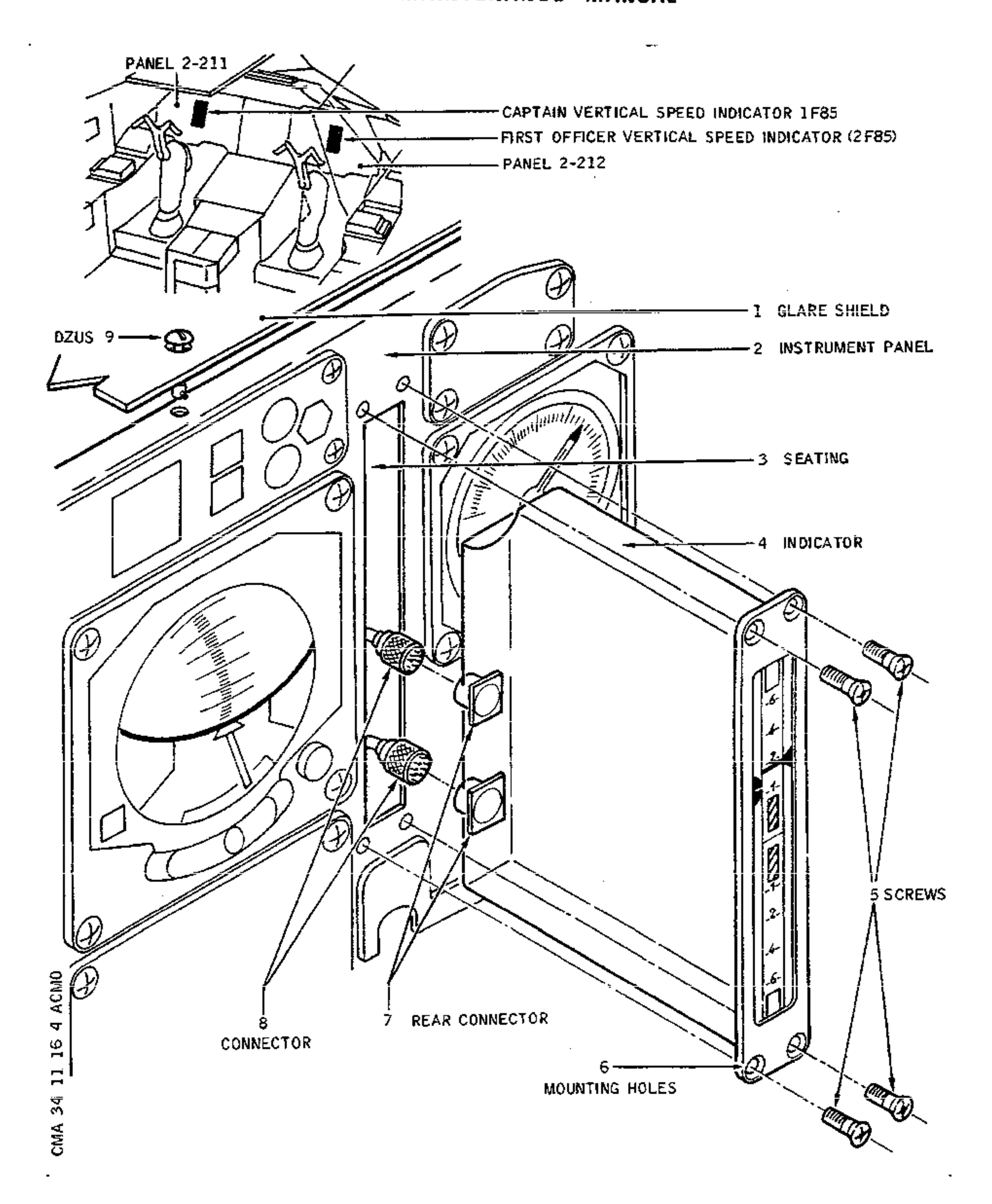
E. Install
(Ref. Fig. 401)

(1) Remove blanking caps from connectors (7) and (8).

(2) Position indicator (4) facing its seating (3) and push it fully home against instrument panel (2).

(3) Install and tighten four mounting screws (5) in indicator holes (6).

(4) Lift glareshield panel (1) partially, then gain access under glareshield panel and connect aircraft connectors (8) to rear connectors (7) on indicator (4).



Removal/Installation of Vertical Speed Indicator
Figure 401

(5) Lower glareshield panel (1) and attach with dzus fasteners (9).

F. Close-Up

(1) Carry out a test of vertical speed indicator (Ref. 34-11-16, Adjustment/Test).

VERTICAL SPEED INDICATOR - ADJUSTMENT/TEST

1. General

The following checks are to be carried out when any of the following components are changed

Capts' V.S.I. 1F85, Capts' V.S.I. Amp. 1F96 (1-215)
F/O's V.S.I. 2F85, Capts' V.S.I. Amp. 2F96 (1-216)

2. Associated Circuit Breaker and Control Switches

Capts' system	26V AC	1F97	on	2-213
	28V DC	1C17	on	1-213 (Datum Adjust)
	115V AC	L372	on	13-215 (5V Integral Lts)
	A.D.C.	1 Master Switch		
F/O's system	26V AC	2F97	on	13-216
	28V DC	2C17	on	5-213 (Datum Adjust)
	115V AC	L371	on	13-215 (5V Integral Lts)
	A.D.C.	2 Master Switch		

3. Component Replacement

Ensure that the power and signal lines to the component are electrically dead by pulling the associated circuit breakers and placing the appropriate ADC master s/w to off.

Check condition of connectors and pins before connecting components into the A/C system.

4. Function Check

A. Reset the appropriate circuit breakers and place the associated ADC master s/w to ON, check that the failure warning flag clears on the V.S.I.

NOTE : If an amplifier has been changed, it may be necessary to adjust the VZ zero position by using the "ZERO ADJUST" potentiometer on the amplifier face.

B. Normal Mode (NOTE : During the A.D.C. Slew the VSI flags may show due to high servo nulls, this is not a system fault.)

(1) Operate the ADC Test Selector Switch to Test 1 position. Check that both Command and Indicator Bugs move together in the positive direction. Allow A.D.C. to reach its test figures and stabilize, bugs should read zero and fail flag should be clear from

view.

(2) Replace ADC Test Selector Switch to NORM position. The command and indicator bugs should move together in the negative direction. Allow A.D.C. to reach ambient conditions and stabilize, bugs should read zero and fail flag should be clear from view.

C. Command Mode (NOTE : During the ADC Slew the VSI fail flag may show due to high servo nulls, this is not a system fault).

(1) Engage the associated flight director and select the vertical speed mode.

(2) Operate the ADC test selector switch to Test 1 position Check that the command bug remains at zero and the A/C indicator bug moves in the positive direction. Allow ADC to stabilize at test figure, bugs should read zero and fail flag should be clear from view.

(3) Replace ADC test switch to NORM position. The command bug should remain at zero and the A/C indicator bug should move in the negative directions. Allow ADC to stabilize at ambient conditions, both bugs should read zero and fail flag should be clear from view.

(4) Place the datum adjust switch to the up, slow and fast positions, check that the command bug increases in the positive direction. The A/C indicator bug should remain at zero.

(5) Return the command bug to the zero position.

(6) Place the datum adjust switch to the down, slow and fast positions. check that the command bug increases in the negative direction. The A/C indicator bug should remain at zero.

(7) Return the command bug to the zero position.

(8) Disengage the flight director.

D. Place the associated ADC master switch to off, check that VSI fail flag shows.

E. End of check.

VSI AMPLIFIER - REMOVAL/INSTALLATION

CAUTION : OBSERVE THE PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

Two VSI amplifiers (1F96A and 2F96A) are mounted in the flight compartment racking on shelves 1-215 and 1-216 respectively. Each VSI amplifier is contained within a rack mounting case forming a single Elfin box (Module) which is in turn installed in an Elfing housing case mounted on the appropriate shelf. The box is secured in the case by two securing screws at the front, and electrical connections are made through an electrical Connector at the rear. A handle on the front of the VSI amplifier facilitates removal and installation of the module.
The VSI amplifiers are installed in an identical manner in the Elfin cases (1-215 or 1-216) ; a single removal/installation procedure will therefore be described.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On centre console 9-211, make certain on ADC control panel that :

(a) ADC1 and ADC2 switches are in OFF position.

(b) TEST selector switches are in NORM position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ADC1 28V SUP	1-213	1F74	P12
AP/FD SYS 1 CONT		1C17	Q13
1ST PLT VSI SUP	2-213	1F97	A3
FLT CONT & NAV BUS 14XS		X355	H2
AP/FD SYS 2 CONT	5-213	2C17	A11
ADC2 28V SUP		2F74	F12
2ND PLT VSI SUP	13-216	2F97	B13
NAV INST BUS 13XS		X345	G4

(3) On electronics rack :

(a) For VSI amplifier (1F96A) remove panel 215GS to gain access to shelf 1-215.

(b) For VSI amplifier (2F96A) remove panel 216GS to gain access to shelf 1-216.

C. Remove

(1) Release the two securing screws and withdraw the VSI amplifier from the Elfin case.

(2) Place blanking caps on connectors.

D. Preparation of Replacement Component

(1) Make certain that Elfin case is clean and that aircraft connector is in good condition.

(2) Make certain that VCI amplifier is in good external condition and that its connector is undamaged and has no trace of corrosion.

E. Install

(1) Remove blanking caps from connectors.

(2) Place the VSI amplifier in its housing in the Elfin case and slide it back until the electrical connector is at the back of the case, ensuring that the unit is bonded in accordance with 20-27-11.

(3) Secure the VSI amplifier to the Elfin case with the two securing screws.

F. Close-up

(1) Carry out a test of vertical speed indicator (Ref. 34-11-16, Adjustment/Test).

(2) On relevant electronics rack, install panel 215GS or 216GS.

TOTAL TEMPERATURE INDICATOR - REMOVAL/INSTALLATION

1. General

The total temperature indicator (3F82) is installed on Flight Engineer panel 4-214.

2. Total Temperature Indicator

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps	

B. Prepare

(1) On Flight Engineer panel 11-214, make certain that PANEL rotary switch is in OFF position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
3CM ADC TEMP INST SUP	13-216	F 105	A15
3CM STN INST LTS SUP		L 377	E 7

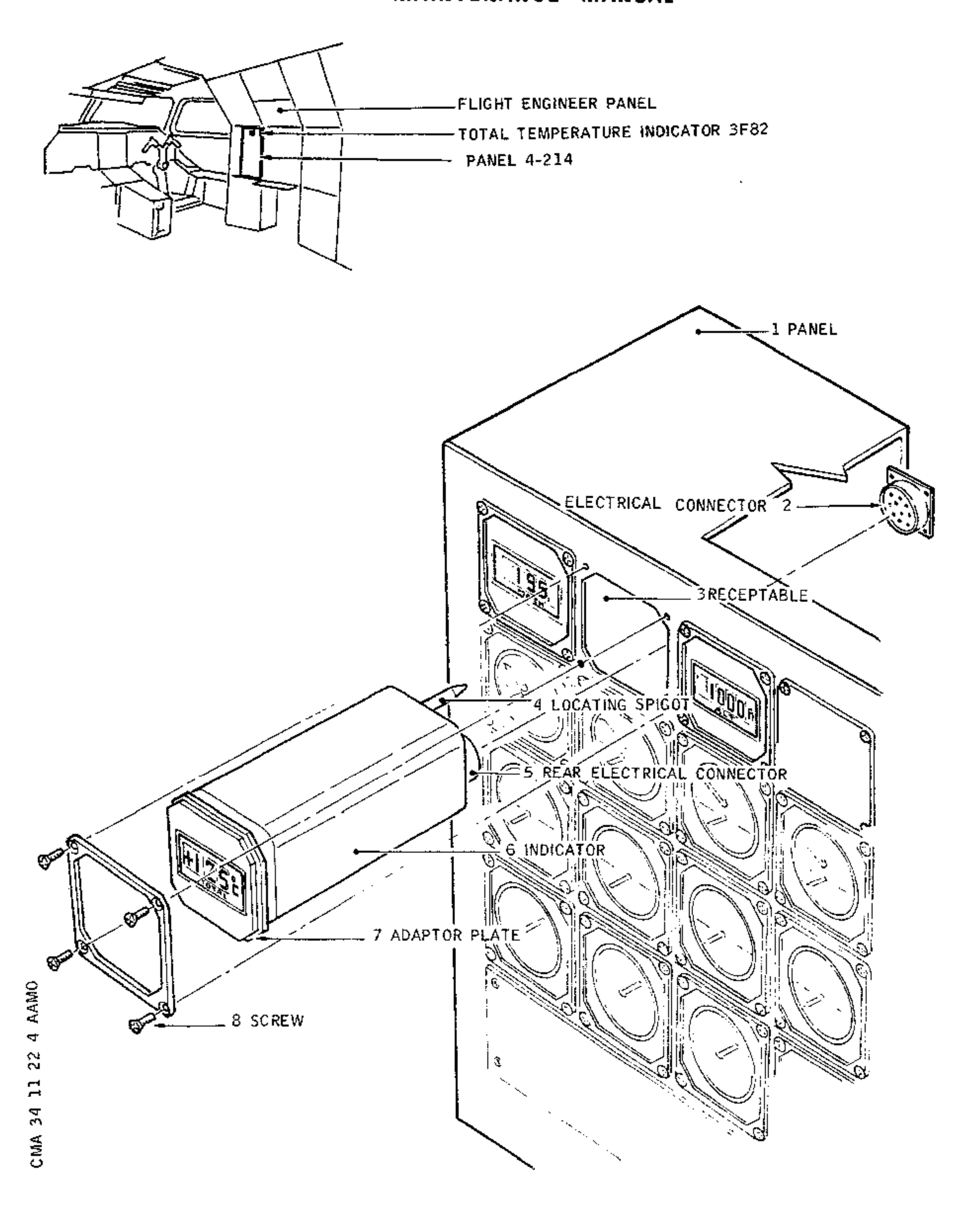
C. Remove (Ref. Fig. 401)

NOTE : The electrical connector at the bottom of the indicator receptacle is spring-loaded, thereby forcing the indicator against the panel with approximately 4.54 daN (10 lbf) pressure.

(1) Hold the face of indicator (6) towards panel (1).

(2) Loosen the four screws (8) securing adaptor plate (7), then holding indicator pressed against the panel, remove the four screws and the adaptor plate.

(3) Gradually release the pressure on the indicator, which will be forced approximately 12 mm (0.5 in.) out of its receptacle (3) by spring pressure.



Removal/Installation of Total Temperature Indicator
Figure 401

(4) Carefully remove the indicator from the panel.

NOTE : The indicator must be supported as it is removed, to allow for the extra weight when the electricall connectors (5) (2) and locating spigot (4) are disengaged.

(5) Cap connectors (5) and (2).

D. Preparation of Replacement Component

(1) Make certain the component interface is clean and that electrical connector is in correct condition.

(2) Visually check that the indicator is in correct condition and that the electrical connector does not show traces of corrosion.

E. Install (Ref. Fig. 401)

(1) Observe electrical safety precautions and uncap electrical connectors (5) and (2)

(2) Engage indicator (6) in receptacle (3) in panel (1).

(3) Align the indicator horizontally and engage locating spigot (4).

(4) Position adaptor plate (7) on indicator face. Slowly engage electrical connectors (5) (2) and fully engage indicator in receptacle.

(5) Hold indicator pressed against panel and install the four screws (8). Tighten screws.

F. Close-Up

(1) Test the total temperature indicator (Ref. 34-11-22, Adjustment/Test).

TOTAL TEMPERATURE DIGITAL INDICATOR - ADJUSTMENT/TEST

1. General

Total temperature digital indicator is located at Flight Engineer's station on panel 4-214.
Indicator is connected to second resistor of total temperature sensor 2F98 located in zone 114.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
3CM ADC TEMP INST SUP	13-216	F 105	A15
3CM STN INST LTS SUP		L 377	E 7

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics racks ventilation system (Ref. 21-21-00).

C. Tests

(1) At Flight Engineer's station, on panel 4-214 check :

(a) On total temperature digital indicator that warning flag has disappeared.

(b) On total temperature digital indicator that indicated temperature is approximately ambient temperature.

(2) At Flight Engineer's station, on panel 11-214, place PANEL rotary switch in position other than OFF.

(a) Integral lighting comes on.

(3) Place PANEL rotary switch in OFF position.

(a) Integral lighting goes off.

D. Close-Up

(1) Switch off electronics racks ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

DIGITAL MACHMETER - REMOVAL/INSTALLATION

1. General

The digital machmeter (3F80) is installed on Flight Engineer panel 4-214.

2. Digital Machmeter

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps	

B. Prepare

(1) On Flight Engineer panel 11-214, make certain that PANEL rotary switch is in OFF position.

(2) On centre console 9-211, on ADC control panel, make certain that :

(a) ADC 1 and ADC 2 switches are in OFF position.

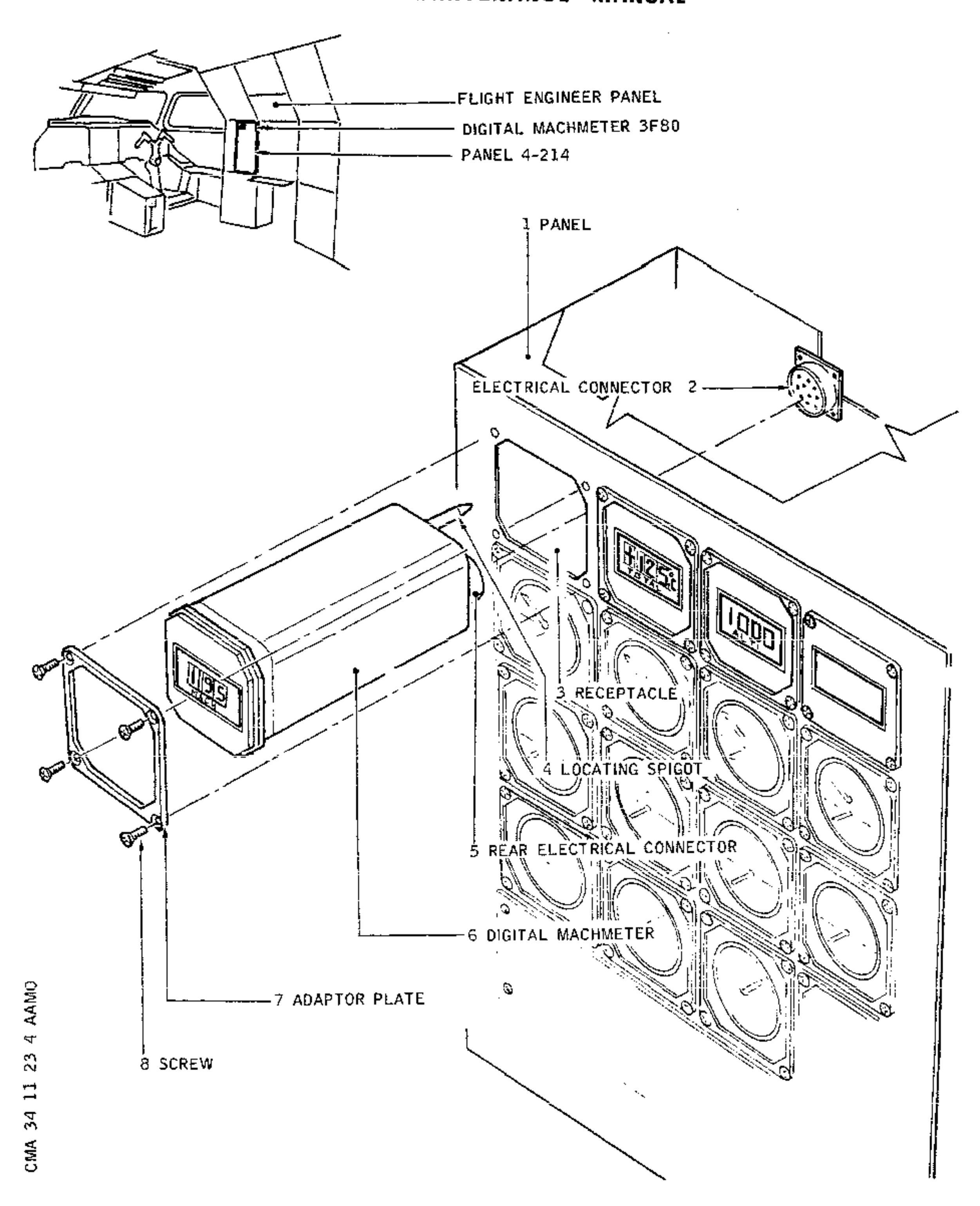
(b) TEST selector switches are in NORM position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC 1 28V SUP	1-213	1F 74	P12
PLT VSI SUP	2-213	1F 97	A 3
FLT CONT & NAV BUS 14XS		X 355	H 2
3CM STN INST LTS SUP	13-216	L 377	E 7
NAV INST BUS 13XS		X 345	G 4

C. Remove (Ref. Fig. 401)

NOTE : The electrical connector at the bottom of machmeter receptacle is spring-loaded, thereby forcing the



Removal/Installation of Digital Machmeter
Figure 401

machmeter against the panel with approximately 4.54 daN (10 lbf) pressure.

(1) Hold the face of machmeter (6) towards panel (1).

(2) Loosen the four screws (8) securing adaptor plate (7), then holding machmeter pressed against the panel, remove the four screws and the adaptor plate.

(3) Gradually release the pressure on machmeter which will be forced approximately 12 mm (0.5 in.) out of receptacle (3) by spring pressure.

(4) Carefully remove machmeter from the panel.

NOTE : The machmeter must be supported as it is removed, to allow for the extra weight when the electrical connectors (5) (2) and locating spigot (4) are disengaged.

(5) Cap electrical connectors (5) and (2).

D. Preparation of Replacement Component

(1) Make certain that component interface is clean and that electrical connector is in correct condition.

(2) Visually check that the digital machmeter is in correct condition and that the electrical connector does not show traces of corrosion.

E. Install (Ref. Fig. 401)

(1) Observe electrical safety precautions.

(2) Engage machmeter (6) in receptacle (3) in panel (1).

(3) Engage machmeter (6) in receptacle (3) in panel (1).

(4) Align machmeter horizontally and engage locating spigot (4).

(5) Position adaptor plate (7) on machmeter face. Slowly engage electrical connectors (5) (2) and fully engage machmeter in receptacle.

(6) Hold machmeter pressed against panel and install the four screws (8). Tighten screws.

F. Close-Up

(1) Remove safety clips and tags and reset circuit breakers tripped in Paragraph 2.B.(3).

(2) Test digital machmeter (Ref. 34-11-23, Adjustment/Test).

Printed in England

DIGITAL MACHMETER - ADJUSTMENT/TEST

1. General

Digital machmeter is located on Flight Engineer's station, on panel 4-214.
Digital machmeter operates from mach information supplied by ADC 1.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 26V SUP	2-213	1F 78	A 2
1ST PLT ADC		1F 75	B 3
ADC1 115V SUP		1F 73	F 3

(2) Trip, safety and tag STICK SHAKER SUP circuit breaker W513, P15 position on panel 1-213.

(3) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(4) Switch on electronics racks ventilation system (Ref. 21-21-00).

C. Tests

(1) At Flight Engineer's station, on panel 11-214, place PANEL rotary switch in position other than OFF :

(a) Digital machmeter integral lighting comes on.

(2) On centre console 9-211,

(a) On ADC control panel check that test selector switches are in NORM position.

(b) Place ADC1 switch in ON position, after 30 seconds approximately, press and release ADC1 amber warning light which remains off.
- On digital machmeter check that warning flag has disappeared.

(3) On centre console 9-211, on ADC control panel, place ADC1 test selector switch in MON position.

(a) ADC1 amber warning light and TEST blue indicator light, system 1, come on.

(b) On digital machmeter, warning flag appears.

(4) On centre console 9-211, on ADC control panel, place ADC1 test selector switch in 1 position.

(a) After a few seconds, TEST blue indicator light comes on.

(b) Press and release ADC1 amber warning light which goes off, digital machmeter flag disappears.

(c) On digital machmeter check that indicated mach number is 0.63 ± 0.03 (this reading can be compared with mach number indicated on Captain's machmeter on instrument panel 2-212).

(5) On centre console 9-211, on ADC control panel :

(a) Place ADC1 test selector switch in NORM position.

(b) Place ADC1 switch in OFF position.

D. Close-Up

(1) On panel 1-213, reset STICK SHAKER SUP circuit breaker W513, P15 position.

(2) At Flight Engineer's station, on panel 11-214, place PANEL rotary switch in OFF position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(4) Switch off electronics racks ventilation system (Ref. 21-21-00).

(5) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

DIGITAL ALTIMETER - REMOVAL/INSTALLATION

1. General

The digital altimeter (3F79) is installed on Flight Engineer panel 4-214.

2. Digital Altimeter

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps	

B. Prepare

(1) On Flight Engineer panel 11-214, make certain that PANEL rotary switch is in OFF position.

(2) On centre console 9-211, on ADC control panel, make certain that :

(a) ADC 1 and ADC 2 switches are in OFF position.

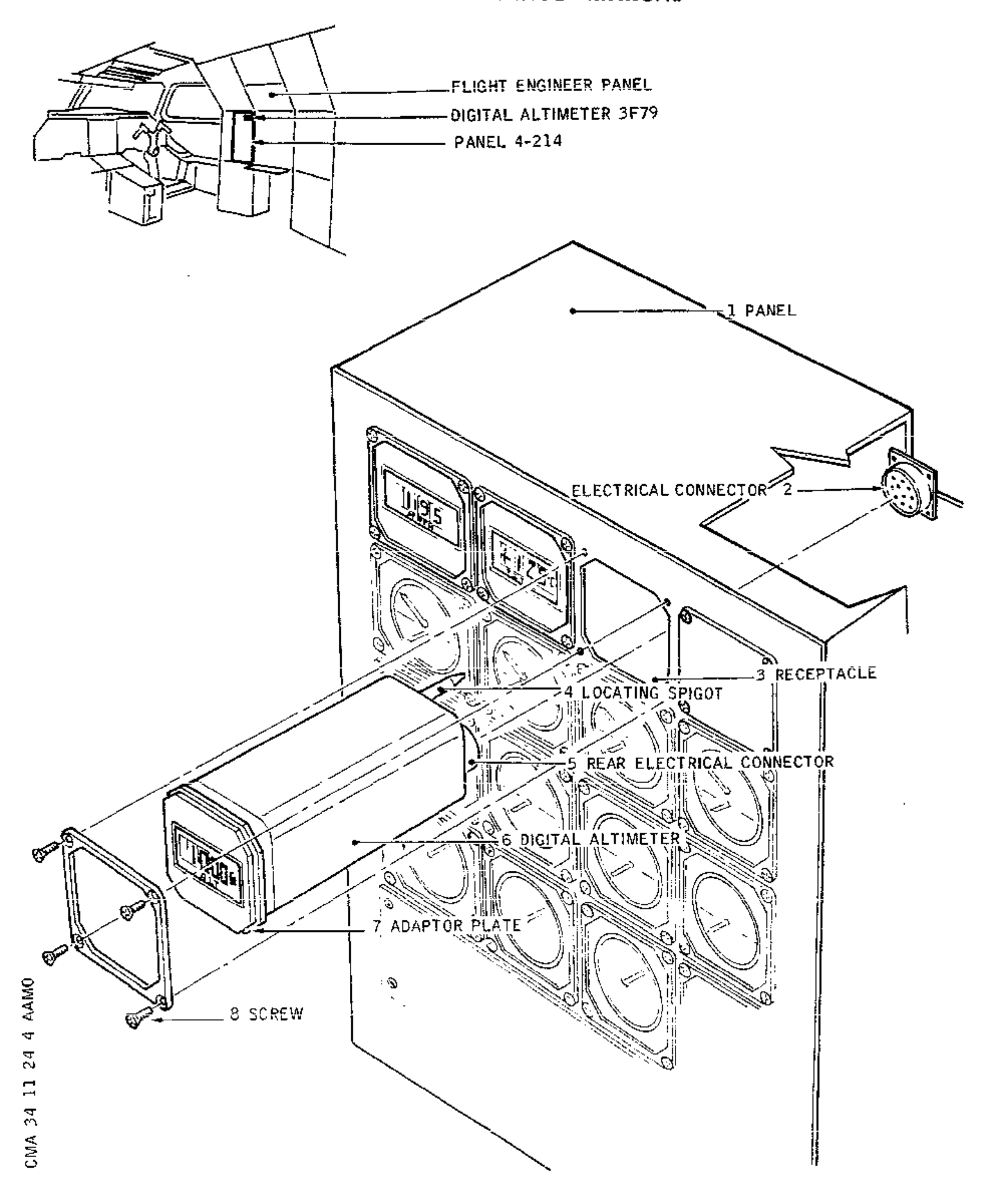
(b) TEST selector switches are in NORM position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
ADC 2 28V SUP	5-213	2F 74	F12
2ND PLT VSI SUP	13-216	2F 97	B13
3CM STN INST LTS SUP		L 377	E 7
NAV INST BUS 13XS		X 345	G 4

C. Remove (Ref. Fig. 401)

NOTE : The electrical connector at the bottom of altimeter receptacle is spring-loaded, thereby forcing the al-



Removal/Installation of Digital Altimeter
Figure 401

timeter against the panel with approximately 4.54 daN (10 lbf) pressure.

(1) Hold the face of altimeter (6) towards panels (1).

(2) Loosen the four screws (8) securing adaptor plate (7), then holding altimeter pressed against the panel, remove the four screws and the adaptor plate.

(3) Gradually release the pressure on altimeter which will be forced approximately 12 mm (0.5 in.) out of the receptacle (3) by spring pressure.

(4) Carefully remove altimeter from the panel.

NOTE : The altimeter must be supported as it is removed to allow for the extra weight when the electrical connectors (5) (2) and locating spigots (4) are disengaged.

(5) Cap electrical connectors (5) and (2).

D. Preparation of Replacement Component

(1) Make certain that component interface is clean and that electrical connector is in correct condition.

(2) Visually check that the digital altimeter is in correct condition and that the electrical connector does not show traces of corrosion.

E. Install (Ref. Fig. 401)

(1) Observe electrical safety precautions.

(2) Uncap electrical connectors (5) and (2).

(3) Engage altimeter (6) in receptacle (3) in panel (1).

(4) Align altimeter horizontally and engage locating spigot (4).

(5) Position adaptor plate (7) on altimeter face. Slowly engage electrical connectors (5) (2) and fully engage altimeter in receptacle.

(6) Hold altimeter pressed against panel and install the four screws (8). Tighten screws.

F. Close-Up

(1) Remove safety clips and tags and reset circuit breakers tripped in Paragraph 2.B.(3).

(2) Test digital altimeter (Ref. 34-11-24, Adjustment/Test).

DIGITAL ALTIMETER - ADJUSTMENT/TEST

1. General

Digital altimeter is located on Flight Engineer instrument panel 4-214
Digital altimeter operates from altitude information supplied by ADC2.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
2ND PLT ALT ASI STBY IND 2ND PLT ADC INST SUP	2-213	2F 88	B 2
ADC2 26V SUP		2F 78	F14
ADC2 115V SUP		2F 73	F15

(2) Trip, safety and tag STICK SHAKER SUP circuit breaker W513, P15 position on panel 1-213.

(3) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(4) Switch on electronics racks ventilation system (Ref. 21-21-00).

C. Tests

(1) At Flight Engineer's station, on panel 11-214, place PANEL rotary switch in position other than OFF.

(a) Digital altimeter integral lighting comes on.

(2) On centre console 9-211

(a) On ADC control panel check that selector switches are in NORM position.

(b) Place ADC2 switch in ON position, after 30 seconds approximately, press and release ADC amber warning light which remains off.
- On digital altimeter check that warning flag has disappeared.

(3) On centre console 9-211, on ADC control panel place ADC2 test selector switch in MON position.

(a) ADC2 amber warning light and TEST blue indicator light, system 2, come on.

(b) On digital altimeter, warning flag appears.

(4) On centre console 9-211, on ADC control panel, place ADC2 test selector switch in 1 position.

(a) After a few seconds, TEST blue indicator light comes on.

(b) Press and release ADC2 amber warning light which goes off, digital altimeter flag disappears.

(c) On digital altimeter, check that indicated altitude is 10.000 ft ± 150 (this reading can be compared with altitude indicated on First Officer's altimeter on instrument panel 2-212).

(5) On centre console 9-211, on ADC control panel.

(a) Place ADC2 test selector switch in NORM position.

(b) Place ADC2 switch in OFF position.

D. Close-Up

(1) On panel 1-213, reset STICK SHAKER SUP circuit breaker W513, P15 position.

(2) At Flight Engineer's station, on panel 11-214, place PANEL rotary switch in OFF position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(4) Switch off electronics racks ventilation system (Ref. 21-21-00).

(5) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

R PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)
R - DESCRIPTION AND OPERATION

R **ON A/C PRE MOD 34G073

1. General

The Passenger Flight Information Display System (PFIDS) comprises four display units, a display converter box and a controller. The display units are mounted on the forward bulkheads of the FWD and AFT passenger cabins one both sides of the aisle. The converter box is positioned next to the ADC2 on shelf 6-216. The controller (used to initialise the system) is positioned on the centre console below the captains INS CDU.

The system is designed to provide a more comprehensive range of information for the passengers than previously afforded by the cabin Machmeter display.

On the ground (after system initialisation) the displays show a plan view of Concorde and a "Welcome to Concorde" message. This remains until the aircraft climbs through 5,000 ft at which point the full time information display commences. The information now available is MACH, FEET (Altitude) TEMP (Static air temp) and MPH (ground speed) left to right across the FWD and AFT cabins. At approx 20 minute intervals one plasma panel per cabin changes to show the Distance To Go for a duration of 4 minutes (approx). When descending past 5,000 ft the displays revert to a "Thank you for flying Concorde" message which will remain until the Cabin Display system is reset.

In the event of an emergency change of flight plan or descent the displays can be blanked showing only a plan view of Concorde. The blanking is achieved by an automatic monitor looking at deceleration rate and descent rate above 27,000 ft or by manual reset using the controller or display power switch.

NOTE: The readouts are not a calibrated system and should never be regarded as authoritative.

2. Cabin Display Digital Converter

The converter performs two functions:

(i) Buffering
(ii) Converting the various aircraft signal formats to a multiplexed Binary Coded Decimal (BCD) signal that can be readily understood by the display units.

The converter receives inputs derived from ADC2 and INS2.

It is contained in a standard 3/8 ATR low profile case mounted next to the ADC2 (6-216). It is supplied with 28 V d.c. and 26 V a.c. 400 Hz from C.B.s A20 on 15-216 and F13 on 13-216 respectively.

R 3. Dedicated Controller (Ref. Fig. 001)

The controller is a panel mounted frame unit. It is positioned on the centre console below the Captains INS/CDU.

The controller acts as an input device for initialisation of the cabin display system and a "repeater" for all the flight parameters as seen by the passengers. The controller communicates with the FWD right hand (master) display via an RS422 data bus. The 28 V d.c. required for the controller is supplied from CB A20 on 15-216.

The controller front plate comprises three function switches (momentary make), a green enter DTG light and a number of seven segment green L.E.D. displays (filtered to improve contrast) which have a brightness control.

The decimal point in the indicator illuminates when power is supplied to the controller so it also serves the function of a "PWR ON" indicator.

4. Cabin Display Units (4 off)

Each display unit consists of two "plasma panels" associated computer circuitry and power supply. The display units are supplied with 28 V d.c. from separate 10 Amp circuit breakers via a 4 pole switch on the FWD stewards panels.

Each "plasma panel" consists of a dot matrix of 100 by 200 separately addressable cells. The display medium is neon gas discharge, filtered to give a green coloured display.

The function of the computer is to interpret BCD information received from the converter box and to receive prompts from information input via the controller.

The FWD RH display position acts as the "Master" unit and is the only unit which can request information from the controller. Connector links establish unit position on the aircraft installation. The "master" display unit performs all the system calculations and mode changes and transmits them on to the other 3 displays using an RS422 signal format.

5. Operation

With all power supplies provided, the FWD R/H display unit (master) requests a Distance-To-Go (DTG) by illuminating the controller ENTER DTG light. The figure 2000 Nautical miles will appear in the controller DTG display. The operator enters the desired Nautical DTG by using the DTG SET switch. The DTG SET switch will add or subtract from 2000 at slow speed for approx 2 secs and then go to high speed. The DTG when set is transmitted by pressing the RESET MON/ENTER switch to ENTER. When the ENTER switch is pressed, the controller transmits the DTG to the master display in STATUTE MILES. The master display then goes to a "Welcome to Concorde" message displayed in the cabin with a plan view of Concorde. The controller ENTER DTG light extinguishes and the nautical DTG display converts to statute DTG. This completes initialisation.

When the aircraft climbs through 5,000 ft the display units change to the flight information mode. The flight information system displays MACH, FEET (Altitude), TEMP (Static), and MPH (Ground Speed) left to right across the FWD and AFT cabins. At intervals of approximately 20 minutes, the TEMP display is replaced by DTG (distance to go) for a period of around 4 minutes thereafter reverting to the TEMP display.

The controller flight parameters (except DTG) will illuminate when the cabin displays go to the flight information mode. As the aircraft descends through 5,000 ft the displays change from flight information to the "Thank you for flying Concorde" message in the FWD and AFT cabins both sides of the aisle. The system will remain in this mode until the system is reset using the controller or by cycling the display power switch. The controller will be blanked except for the decimal point on the mach display.

If an emergency descent or air turn back is necessary then a manual blanking of the displays can be achieved by pressing TURN and ENTER simultaneously on the controller. The controller will blank and then illuminate the ENTER DTG light with 2000 displayed. If a new DTG is entered then the flight parameters will be re-introduced otherwise the displays will only show a plan view of Concorde.

With the altitude above 27,000 ft, a full time MONITOR automatically detects a rate of descent in excess of 8,000 ft per min. or a rate of deceleration in excess of 0.375 Mach per min. For either condition, the displays will be blanked and a plan view of Concorde put up. The controller top line will blank and a horizontal line will be lit in the Mach and/or Alt display to identify which monitor tripped. To prevent nuisance trips a monitor must be tripped over 16 seconds to cause a full display blanking sequence.

Once the monitor trip has cleared or the aircraft descends through 27,000 ft then the flight information and DTG modes will be automatically re-instated after 5 minutes. During the 5 minute period the horizontal bar/s in the Mach and/or Alt controller displays will flash. Pressing the RESET MON/ENTER switch to RESET MON will manually re-instate the flight parameter displays allowing a co-ordinated public address. The original DTG will still have been updated.

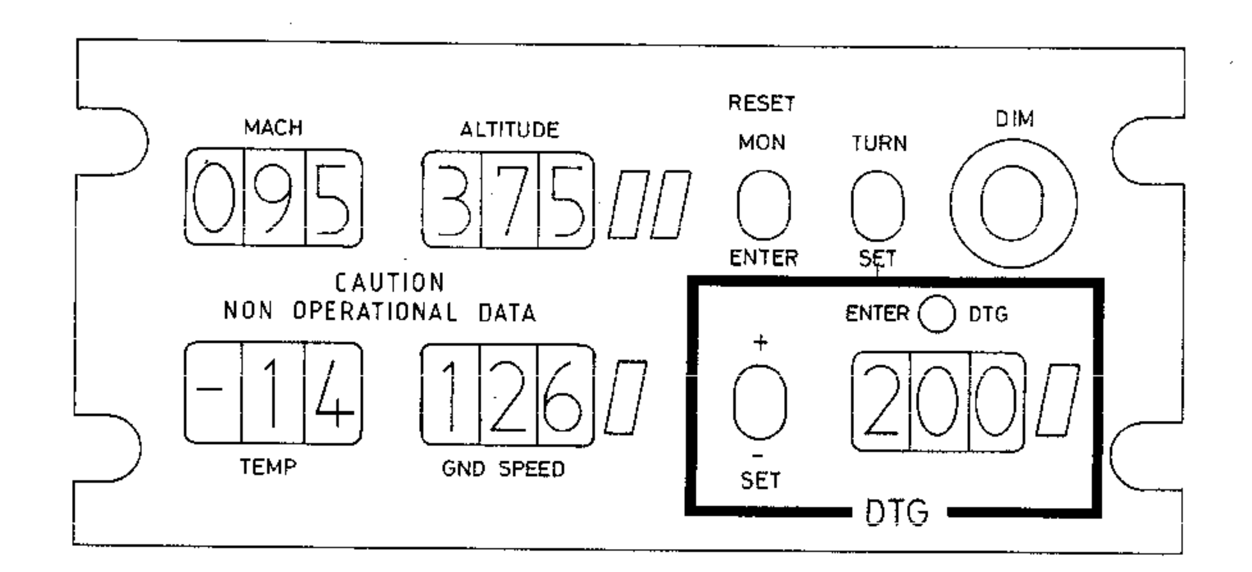
At any time after initialisation of the system, the pressing of SET and ENTER simultaneously will cause a complete system reset as if a power down has occurred and the controller CDU will blank and request DTG in the usual manner.

The DTG mode will be inhibited in flight if the calculated DTG value is less than 50 miles.

If the display power switch is switched to "OFF" then it should remain "OFF" for a minimum of 10 seconds to ensure that the display power transient protection has fully powered down allowing a complete display reset.

The display units are configured such that the FWD right hand display acts as a "master", carrying out all calculations and mode decisions. The master unit then transmits this information to the other 3 display units. The display units are fully interchangeable.

To enable the system to highlight the Mach 1 and Mach 2 points the Mach display will show Mach 1 for values between 0.98 and 1.02 and Mach 2 for values above 1.97.



CMB 34 11 27 01 ACM0 00

Dedicated Controller
Figure 001



PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS) - DESCRIPTION AND OPERATION

**ON A/C POST MOD 34G073

1. General

The Passenger Flight Information Display System (PFIDS) comprises of four Visual Display Units (VDUs), a Cabin Display Digital Converter and a Controller. Two VDUs are mounted on the forward bulkheads of the forward and aft passenger cabins, one each side of the aisle. The Converter is installed in the RH radio rack, shelf 6-216. The Controller is installed on the flight deck, left of the centre pedestal.

The system is designed to provide a more comprehensive range of information for the passengers than previously afforded by the cabin Machmeter display.

On the ground (after system initialisation) the displays show a plan view of Concorde and a "Welcome to Concorde" message. This remains until the aircraft climbs through 5,000 ft at which point the full time information display commences. The information now available is MACH, FEET (Altitude) TEMP (Static air temp) and MPH (ground speed) left to right across the FWD and AFT cabins. At approx 20 minute intervals one plasma panel per cabin changes to show the Distance To Go for a duration of 4 minutes (approx). When descending past 5,000 ft the displays revert to a "Thank you for flying Concorde" message which will remain until the Cabin Display system is reset.

In the event of an emergency change of flight plan or descent the displays can be blanked showing only a plan view of Concorde. The blanking is achieved by an automatic monitor looking at deceleration rate and descent rate above 27,000 ft or by manual reset using the controller or display power switch.

NOTE: The readouts are not a calibrated system and should never be regarded as authoritative.

2. Cabin Display Digital Converter

The Cabin Display Digital Converter is contained in a standard 3/8 ATR low profile case mounted in the RH radio rack, shelf 6-216 next to the ADC2.

The converter receives input data from ADC2 and INS2:

The Groundspeed data is obtained in an ARINC 561 digital signal format from the aircraft Inertial Navigation System No.2.

The MACH ratio is obtained from a potentiometer in the Air Data Computer No.2.

The Distance to Go figure is calculated in the systems computer from the groundspeed figure and the trip total distance entered into the system by the crew prior to flight.

The Static Air Temperature signal is obtained as a DC analogue voltage ratio in an ARINC 565 signal format from the Air Data Computer No.2.

The Altitude signal is collected as a fine/coarse three-wire synchro format signal obtained from the Air Data Computer No.2.

The Converter changes all the above signals into a multiplexed Binary Coded Decimal (BCD) output which can be read by the master VDU.

3. Dedicated Controller

The controller is a panel mounted frame unit. It is positioned on the flight deck centre console below the Captain's INS/CDU.

The controller acts as an input device for initialisation of the cabin display system and as a 'repeater' for all the flight parameters as displayed to the passengers. The controller communicates with the FWD RH (master) display via an RS422 data bus.

The controller front plate comprises three function switches (momentary make), a green 'Enter DTG' light and a number of seven-segment green L.E.D. displays (filtered to give contrast) which have a brightness control.

The decimal point in the display illuminates when power is supplied to the controller serving as a 'PWR ON' indicator.

The 28 V dc required for the controller is supplied from CBA20 on 15-216.

4. Visual Display Unit (VDU) (4 off)

The VDUs are mounted on the FWD bulkheads of the FWD and AFT passenger cabins, 1 each side of the aisle.

Each VDU consists of two Electro-Luminescent (EL) screens giving a yellow display, associated computer circuitry and power supply. The purpose of the computer is to interpret BCD information received from the Cabin Display Digital Converter and to receive prompts from information input via the controller.

The FWD RH VDU acts as the 'master' unit and is the only unit which can request information from the controller. Connector links establish unit position on the aircraft installation. The 'master' VDU performs all the system calculations and mode changes and transmits them on to the other 3 VDUs using an RS422 signal format.

The data displayed is limited to the following messages:

A "Welcome to Concorde" message.

A "Thank You for flying Concorde" message.

A stand-by image of a plan view of Concorde.

Groundspeed	This is shown with a label "MPH. Displayed in M.P.H. with a resolution of 10 M.P.H.
MACH Ratio	This is shown with a label "MACH". Displayed with a resolution of two places of decimal. (To enable the system to highlight the Mach 1 and Mach 2 points, the Mach display will show Mach 1 for values between 0.98 and 1.02, and Mach 2 for values above 1.97).
Distance to Go	This is shown with a label "DTG". Displayed in statute miles with a resolution of 10 miles.
Static Air Temperature	This is shown with a label "TEMP". Displayed in degrees Centigrade with a resolution of 1 degree Centigrade.
Altitude	This is shown with a label "ALT". Displayed in feet with a resolution of 500 feet.

The VDUs are supplied with 28 V d.c. from CBs G11, G13, G15 and G17 on 15-215 via a 4-pole switch on the FWD stewards panel.

5. Operation

The system is designed to operate with a minimum of control or inputs.

Normal Operation

Make sure that the system ON/OFF switch on the cabin services panel is switched ON. On application of power, the display panels should show a brief test message, and then go blank.

The controller will have all the flight information windows blank, and 2000 nautical miles indicated in the DTG window. The "ENTER DTG" lamp will be lit.

Using the +/- switch adjacent to the DTG window adjust the DTG to the correct figure. The DTG can only be entered to the nearest 10 nautical miles. When the correct figure shows in the DTG window, press the ENTER switch.

The "ENTER DTG" light will extinguish and within a few seconds, the controller will show a new figure in the DTG window. The new figure will be a statute miles conversion from the nautical miles entered. The system will now display a "Welcome to Concorde" message. This completes initialisation.

When the aircraft climbs through 5,000 ft the display units change to the flight information mode. The flight information system displays MACH, FEET (Altitude), TEMP (Static), and MPH (Ground Speed) left to right across the FWD and AFT cabins. At intervals of approximately 20 minutes, the TEMP display is replaced by DTG (distance to go) for a period of around 4 minutes thereafter reverting to the TEMP display.

The controller flight parameters (except DTG) will illuminate when the cabin displays go to the flight information mode. As the aircraft descends through 5,000 ft the displays change from flight information to the "Thank you for flying Concorde" message in the FWD and AFT cabins both sides of the aisle. The system will remain in this mode until the system is reset using the controller or by cycling the display power switch. The controller will be blanked except for the decimal point on the mach display.

After the flight is complete, the system will automatically revert to the start of the sequence after forty minutes. However, at any time the system can be reset by simultaneously pressing the "SET" and "ENTER" switches.

Abort Mode

In the case of the aircraft having to turn back or substantially deviating from the flight plan, there is the facility within the system to suppress the normal flight parameters to avoid alarming the passengers.

This mode can be selected by pressing the "TURN" and "ENTER" switches simultaneously.

The system will now only display a stand-by plan view of Concorde, and the "ENTER DTG" lamp will illuminate, prompting the crew to enter a new DTG.

Using the +/- switch adjacent to the DTG window, adjust the DTG to the correct figure. The DTG can only be entered to the nearest 10 nautical miles. When the correct figure shows in the DTG window, press the ENTER switch. The "ENTER DTG" will extinguish.

NOTE: The DTG mode will be inhibited in flight if the calculated DTG value is less than 50 miles.

If an individual VDU fails during flight, then the system should be shut down by using the system ON/OFF switch installed on the cabin services panel situated in the entrance vestibule.

Trip Mode

With the altitude above 27,000 ft, a full time monitor automatically detects a rate of descent in excess of 8,000 ft per min. or a rate of deceleration in excess of 0.375 Mach per min. For either condition, the system will shut down so as not to alarm the passengers. While tripped off, the system will display a stand-by plan view of Concorde. The controller will indicate to the crew that a trip has occurred by blanking the controller displays and putting a line in the window of the parameter that has actually tripped.

To prevent nuisance trips a monitor must be tripped over 16 seconds to cause a full display blanking sequence.

Once the monitor trip has cleared or the aircraft descends through 27,000 ft then the flight information and DTG modes will be automatically re-instated after 5 minutes. During the 5 minute period the horizontal bar/s in the Mach and/or Alt controller displays will flash. Pressing the RESET MON/ENTER switch to RESET MON will manually re-instate the flight parameter displays allowing a co-oprdinated public address. The original DTG will still have been updated.

R PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)
R - TROUBLE SHOOTING

R **ON A/C PRE MOD 34G073

1. General Fault Finding

Unless a fault can be reproduced, the best action for display faults is to interchange.

When resetting units by powering down, a minimum of 30 seconds depowered is advisable when fault finding.

Individual slave display units may be depowered for flight pending replacement (i.e. to ADD) but a faulty master unit must be moved to a slave position to achieve normal operation of the system pending replacement action.

Suspect display units should not be swapped into the master position (fwd R/H).

Using the RESET MON switch after a monitor trip will only be actioned if the rate of deceleration or descent has fallen below the trip levels. The TURN and ENTER or SET and ENTER commands will always be actioned.

2. Fault Finding

The following is a list of recommended fault finding actions based on the most common tech log entries (as encountered on the modified PFIDS) to date.

A. Individual plasma panel "stuck" in any mode

If the plasma panel resets when display is powered down or reset using SET and ENTER then interchange display with a known serviceable partner. Continuous intermittent stuck panels on a display should be treated as suspect and the display unit removed. Ensure S/No. of displays are recorded in Tech. Log for interchanges.

B. Single or Double plasma panel blanking

If the individual plasma panel/panels do not have faint, horizontal yellow/green lines when power is applied prior to initialisation then the display unit has an internal power supply fault. Replace display unit.

If plasma panel has flight parameter title but no data showing, check other cabin. If the data is showing in the other cabin then interchange the suspect display unit with known serviceable unit. If data not showing in other cabin then interchange the "master" display unit.

NOTE: Blank flight parameter data may be due to lack of relevant latch enable pulses or BCD data from display converter to the "master" display.

C. DTG - intervals between displayed information > 25 minutes.

Using ground test of system, run ADC2 between Test position 1 and Test position 2. Note the time taken between updates on the Displays. If the update takes longer than 9.5 seconds then the digital converter internal clock is running slow. Replace digital converter.

R D. Master display and/or controller will not change modes. (Slave display units may/may not function normally).

Interchange master display unit with known serviceable unit.

NOTE: The controller is controlled by the master display.

E. Multiple Monitor Trips

If trips occur without association to flight decents or accelerations then the following action is recommended. Connect the Crouzet air data test box P/N 87209455 (Code GEESO 872). Slowly run the Mach and Altitude up and down INDEPENDENTLY (Altitude above 27,000 ft). Watch the controller for any "jumps" (in a downward sense) large enough to cause a monitor trip. Loss of data word "bits" can result in large changes of Mach or Altitude. Refer to WDM 34-11-98. Change converter or check wiring as necessary.

PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)
- TROUBLE SHOOTING

** ON A/C POST MOD 34G073

1. General Fault Finding

Unless a fault can be reproduced, the best action for display faults is to interchange.

When resetting units by powering down, a minimum of 30 seconds depowered is advisable when fault finding.

Individual slave VDUs units may be depowered for flight pending replacement (i.e. to ADD) but a faulty master unit must be moved to a slave position to achieve normal operation of the system pending replacement action.

Suspect VDUs should not be swapped into the master position (fwd R/H).

Using the RESET MON switch after a monitor trip will only be actioned if the rate of deceleration or descent has fallen below the trip levels. The TURN and ENTER or SET and ENTER commands will always be actioned.

2. Fault Finding

The following is a list of recommended fault finding actions based on the most common tech log entries (as encountered on the modified PFIDS) to date.

A. Individual display panel "stuck" in any mode

If the display panel resets when display is powered down or reset using SET and ENTER then interchange display with a known serviceable partner. Continuous intermittent stuck panels on a display should be treated as suspect and the VDU removed. Ensure S/No. of VDU are recorded in Tech. Log for interchanges.

B. Single or double display panel blanking

If a display panel has flight parameter title but no data showing, check other cabin. If the data is showin in other cabin then interchange the suspect VDU with known serviceable unit. If data not showing in other cabin then interchange the "master" VDU.

NOTE: Blank flight parameter data may be due to lack of relevant latch enable pulses or BCD data from display converter to the "master" VDU.

C. DTG - intervals between displayed information > 25 minutes.

Using ground test of system, run ADC2 between Test position 1 and Test position 2. Note the time taken between updates on the displays. If the update takes longer than 9.5 seconds then the digital converter internal clock is running slow. Replace digital converter.

D. Master VDU and/or controller will not change modes. (Slave VDUs may/may not function normally).

Interchange VDU unit with known serviceable unit.

NOTE: The controller is controlled by the master VDU.

E. Multiple Monitor Trips

If trips occur without association to flight decents or accelerations then the following action is recommended. Connect the Crouzet air data test box P/N 87209455 (Code GEESO 872). Slowly run the Mach and Altitude up and down INDEPENDENTLY (Altitude above 27,000 ft). Watch the controller for any "jumps" (in a downward sense) large enough to cause a monitor trip. Loss of data word "bits" can result in large changes of Mach or Altitude. Refer to WDM 34-11-98. Change converter or check wiring as necessary.

R PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS) - REMOVAL/INSTALLATION

R **ON A/C PRE MOD 34G073

R 1. Display Unit - Removal/Installation (Ref. Fig. 401)

A. Remove power by opening the following system circuit breakers:

C.B. G15 on panel 15-215. FWD LH Display 28 V d.c.
C.B. G11 on panel 15-215. FWD RH Display 28 V d.c.
C.B. G17 on panel 15-215. AFT LH Display 28 V d.c.
C.B. G13 on panel 15-215. AFT RH Display 28 V d.c.
C.B. A20 on panel 15-216. Converter 28 V d.c. supply.
C.B. F13 on panel 13-216. Converter 26 V a.c. supply.

B. Remove the protective shroud from around the display unit.

C. Disconnect the electrical plug/s. (FWD RH position has 2 connectors).

D. Remove six securing bolts through the support bracket from the rear of the bulkhead.

NOTE 1: Display units weigh approximately 7 kg so they should be adequately supported during removal/ installation. Care should be taken to avoid damaging the plasma screens as they are fragile and easily cracked.

NOTE 2: Ensure that a purpose built case, P/N NRTC0042F is used to protect display units in transit.

E. Replace display unit and refit securing screws.

F. Reconnect the electrical plug/s, refit protective shroud and reset system circuit breakers. Carry out functional test in accordance with Adjustment/Test.

R 2. Converter Box - Removal/Installation (Ref. Fig. 402)

A. Remove power by opening the following system circuit breakers:

C.B. G15 on panel 15-215. FWD LH Display 28 V d.c.
C.B. G11 on panel 15-215. FWD RH Display 28 V d.c.
C.B. G17 on panel 15-215. AFT LH Display 28 V d.c.
C.B. G13 on panel 15-215. AFT RH Display 28 V d.c.
C.B. A20 on panel 15-216. Converter 28 V d.c. supply.
C.B. F13 on panel 13-216. Converter 26 V a.c. supply.
C.B. F12 on panel 15-213. ADC2 28 V d.c. supply
C.B. F15 on panel 13-216. ADC2 115 V a.c. supply.

B. On Shelf 6-216 (Aft of ADC2) release converter box fasteners and remove converter box.

C. Replace converter box and secure fasteners.

D. Return power supplies to normal and carry out system functional test as per Adjustment/Test.

NOTE: Do not attempt to adjust potentiometers on front of converter box as they are workshop set.

3. Dedicated Controller - Removal/Installation

A. Remove power by opening the following breakers:

C.B. G15 on panel 15-215.	FWD LH Display 28 V d.c.
C.B. G11 on panel 15-215.	FWD LH Display 28 V d.c.
C.B. G17 on panel 15-215.	AFT LH Display 28 V d.c.
C.B. G13 on panel 15-215.	AFT LH Display 28 V d.c.
C.B. A20 on panel 15-216.	Converter 28 V d.c.
C.B. F13 on panel 13-216.	Converter 26 V a.c.
C.B. B8 on panel 14-216.	Centre console light supply a.c.

B. Release the four Dzus fasteners and remove controller.

C. Release the electrical connector.

D. Reconnect connector to the new controller and secure the controller with the four Dzus fasteners.

E. Close breakers as per para A.

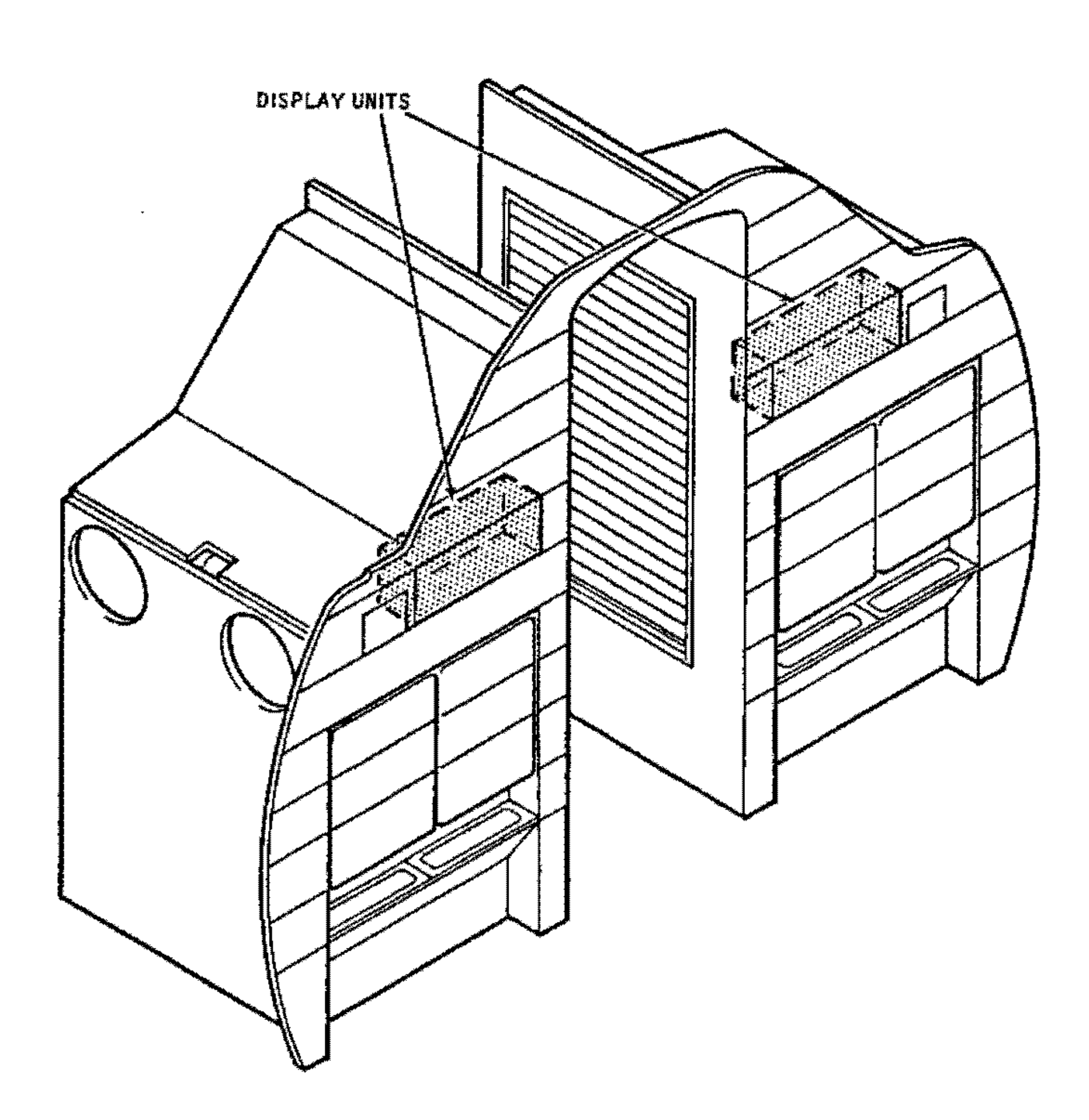
F. Check the decimal point on the mach indicator illuminates.

G. Switch on display power at FWD stewards panel. Controller ENTER DTG light illuminates and 2000 displayed. Check operation of DTG SET switch and press ENTER. After a short pause the ENTER DTG light will extinguish and the DTG display will change to show Statute miles.

H. Check operation of panel lights by operation of centre console dimming control knob of panel 4-211.

I. Remove power by switching FWD stewards display power switch to OFF.

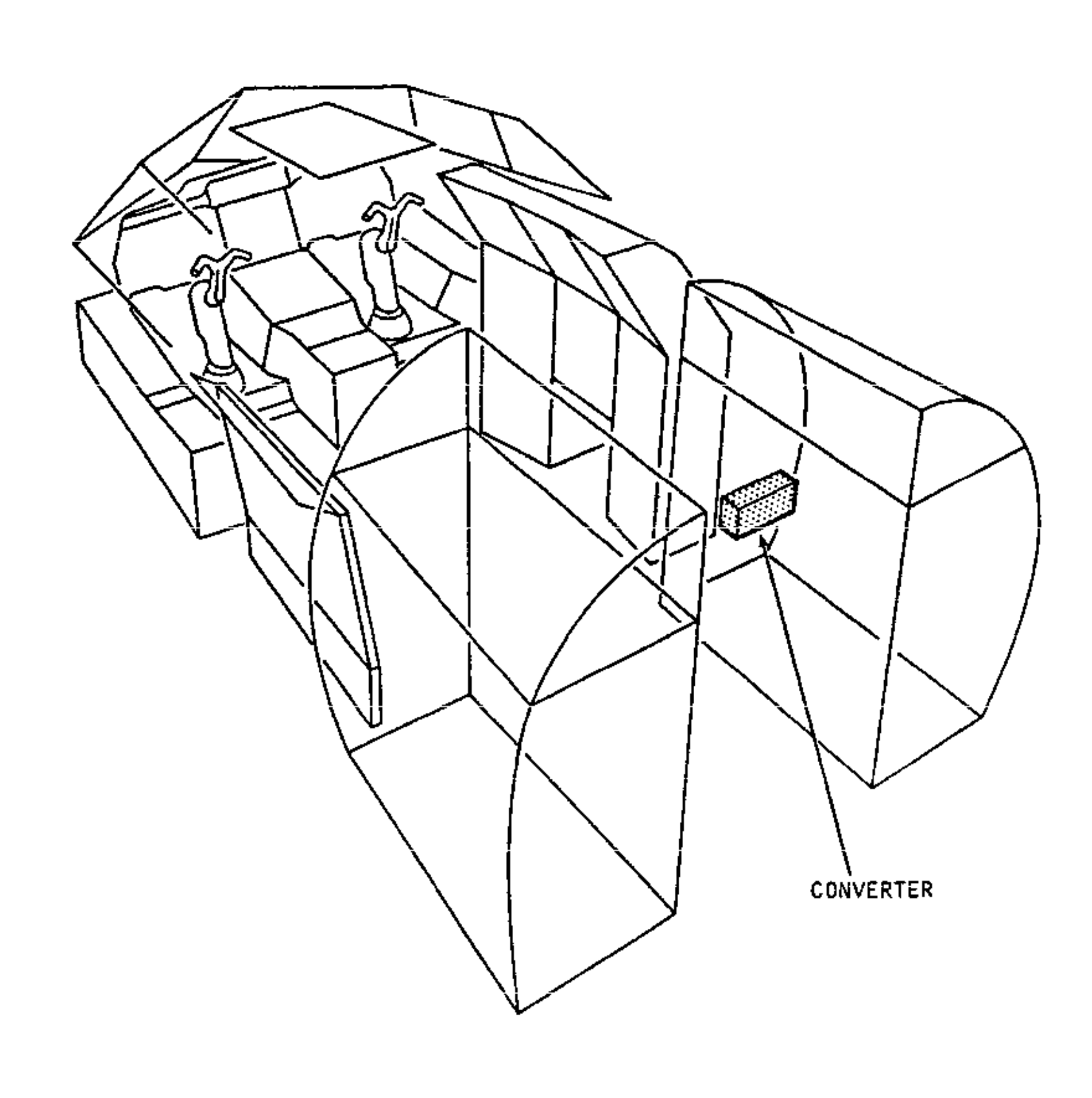
CIC0135/00A



CMB 34 11 27 40 AAM0

Display Unit Location
Figure 401

CIC0136/00A



CMB 34 11 27 40 ACMO

Converter Box Location
Figure 402

PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS) - REMOVAL/INSTALLATION

** ON A/C POST MOD 34G073

1. Visual Display Unit, Part No. 999-44115-201 - Removal/Installation (Ref. Fig. 401)

   A. Remove power by opening the following system circuit breakers:

C.B. G15 on panel 15-215.	FWD LH Display 28 V d.c.
C.B. G11 on panel 15-215.	FWD RH Display 28 V d.c.
C.B. G17 on panel 15-215.	AFT LH Display 28 V d.c.
C.B. G13 on panel 15-215.	AFT RH Display 28 V d.c.
C.B. A20 on panel 15-216.	Converter 28 V d.c. supply.
C.B. F13 on panel 13-216.	Converter 26 V a.c. supply.

   B. Remove the protective shroud from around the visual display unit.

   C. Disconnect the electrical plug/s. (FWD RH position has 2 connectors).

   D. Remove six securing bolts through the support bracket from the rear of the bulkhead.

   NOTE 1: Visual display units are heavy and should be adequately supported during removal/installation. Care should be taken to avoid damaging the display screens as they are fragile and easily cracked.

   NOTE 2: Ensure that a purpose built case, P/N NRTC0042F is used to protect display units in transit.

   E. Replace visual display unit and refit securing screws.

   F. Reconnect the electrical plug/s, refit protective shroud and reset system circuit breakers. Carry out functional test in accordance with Adjustment/Test.

2. Digital Converter Box - Removal/Installation (Ref. Fig. 402)

   A. Remove power by opening the following system circuit breakers:

C.B. G15 on panel 15-215.	FWD LH Display 28 V d.c.
C.B. G11 on panel 15-215.	FWD RH Display 28 V d.c.
C.B. G17 on panel 15-215.	AFT LH Display 28 V d.c.
C.B. G13 on panel 15-215.	AFT RH Display 28 V d.c.
C.B. A20 on panel 15-216.	Converter 28 V d.c. supply.
C.B. F13 on panel 13-216.	Converter 26 V a.c. supply.
C.B. F12 on panel 15-213.	ADC2 28V d.c. supply
C.B. F15 on panel 13-216.	ADC2 115V a.c. supply.

   B. On Shelf 6-216 (Aft of ADC2) release converter box fasteners and remove converter box.

C. Ensure that converter box has Engineering Change Order ECO0028 installed, indicated by an 'A' stamped on the name plate.

D. Replace converter box and secure fasteners.

E. Return power supplies to normal and carry out system functional test as per Adustment/Test.

NOTE: Do not attempt to adjust potentiometers on front of converter box as they are workshop set.

3. Controller - Removal/Installation (Ref. Fig. 403)

A. Remove power by opening the following breakers:

C.B. G15 on panel 15-215. FWD LH Display 28 V d.c.
C.B. G11 on panel 15-215. FWD LH Display 28 V d.c.
C.B. G17 on panel 15-215. AFT LH Display 28 V d.c.
C.B. G13 on panel 15-215. AFT LH Display 28 V d.c.
C.B. A20 on panel 15-216. Converter 28 V d.c.
C.B. F13 on panel 13-216. Converter 26 V a.c.
C.B. B8 on panel 14-216. Centre console light supply a.c.

B. Release the four Dzus fasteners and remove controller.

C. Release the electrical connector.

D. Reconnect connector to the new controller and secure the controller with the four Dzus fasteners.

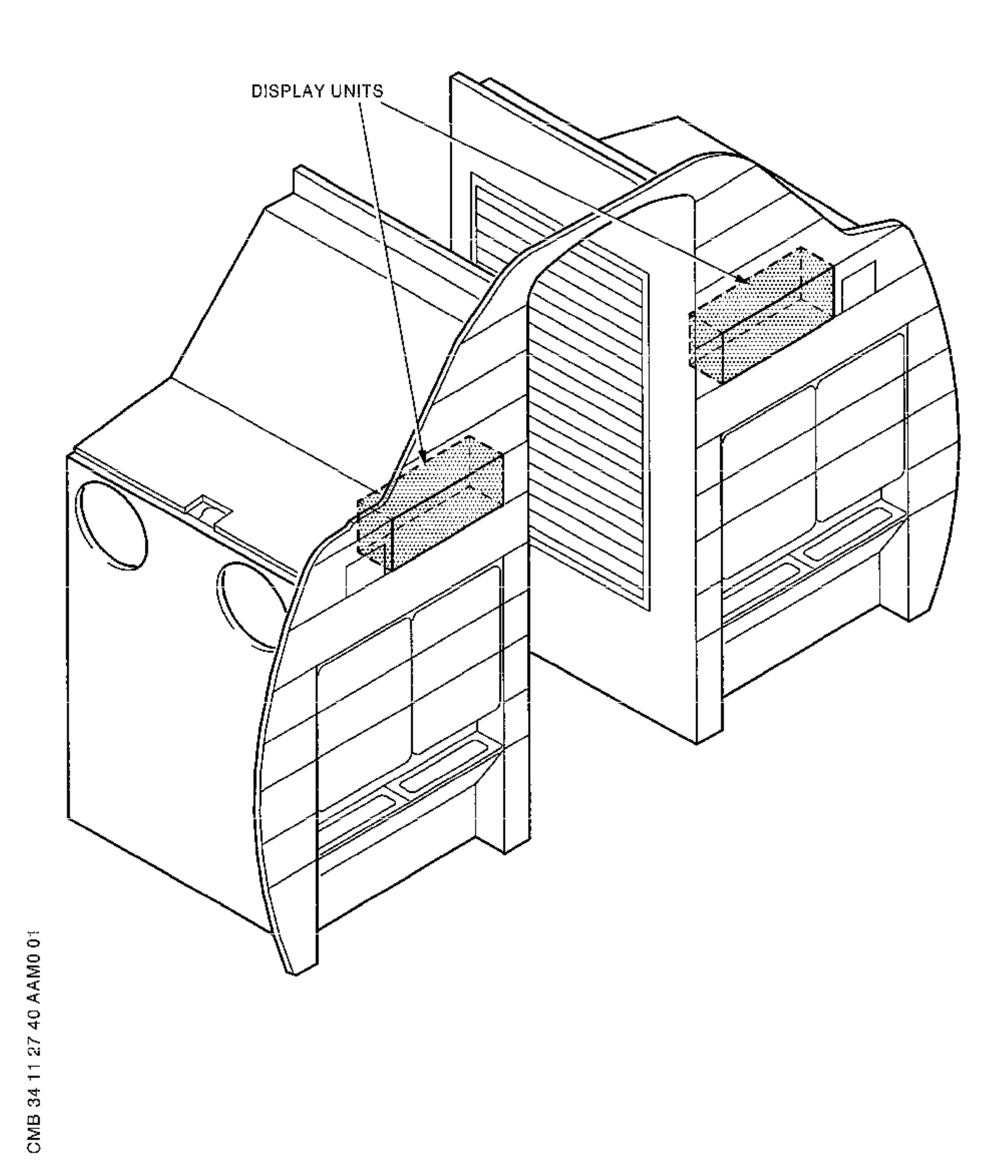
E. Close breakers as per para A.

F. Check the decimal point on the mach indicator illuminates.

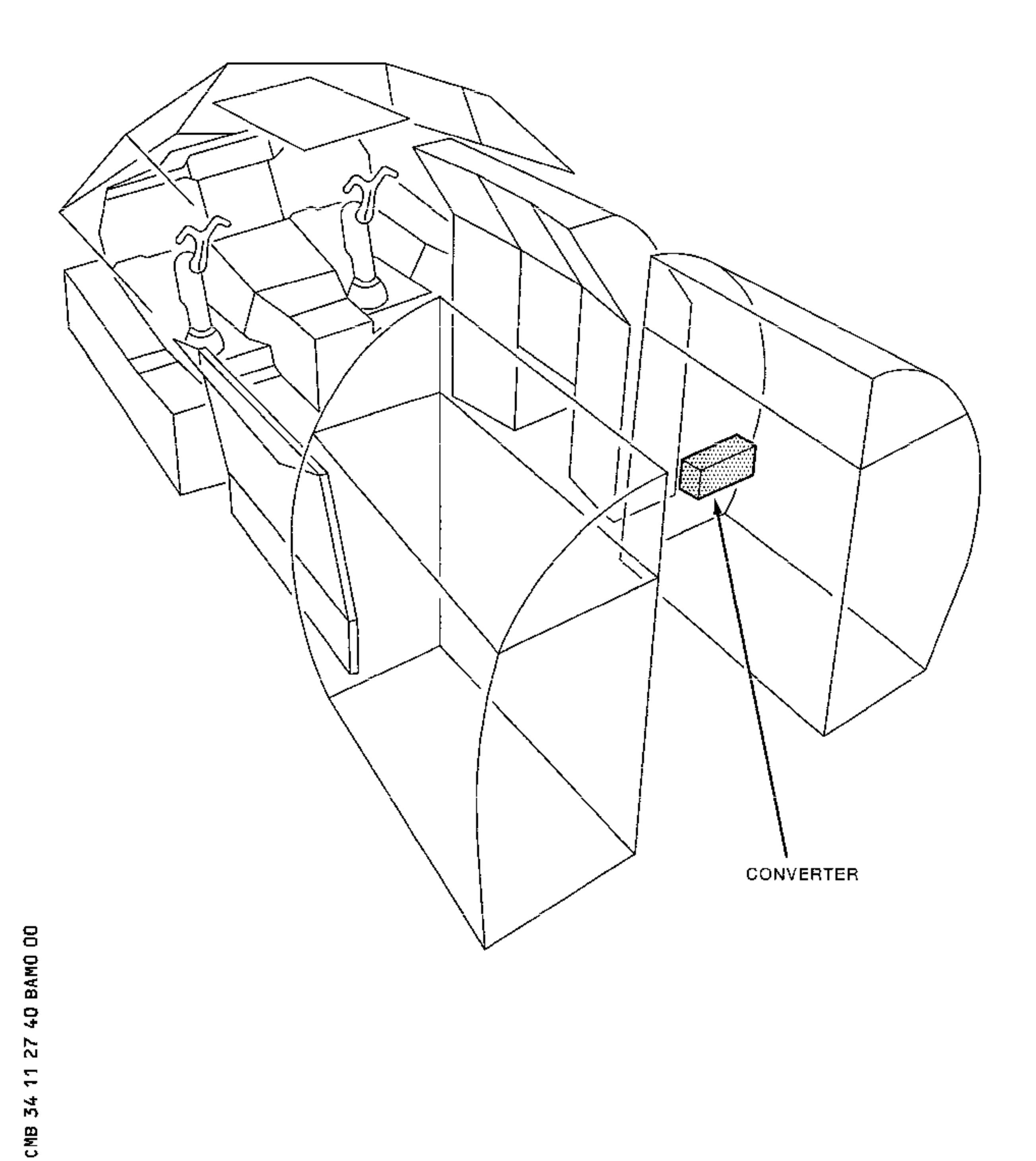
G. Switch on display power at FWD stewards panel. Controller ENTER DTG light illuminates and 2000 displayed. Check operation of DTG SET switch and press ENTER. After a short pause the ENTER DTG light will extinguish and the DTG display will change to show Statute miles.

H. Check operation of panel lights by operation of centre console dimming control knob of panel 4-211.

I. Remove power by switching FWD stewards display power switch to OFF.

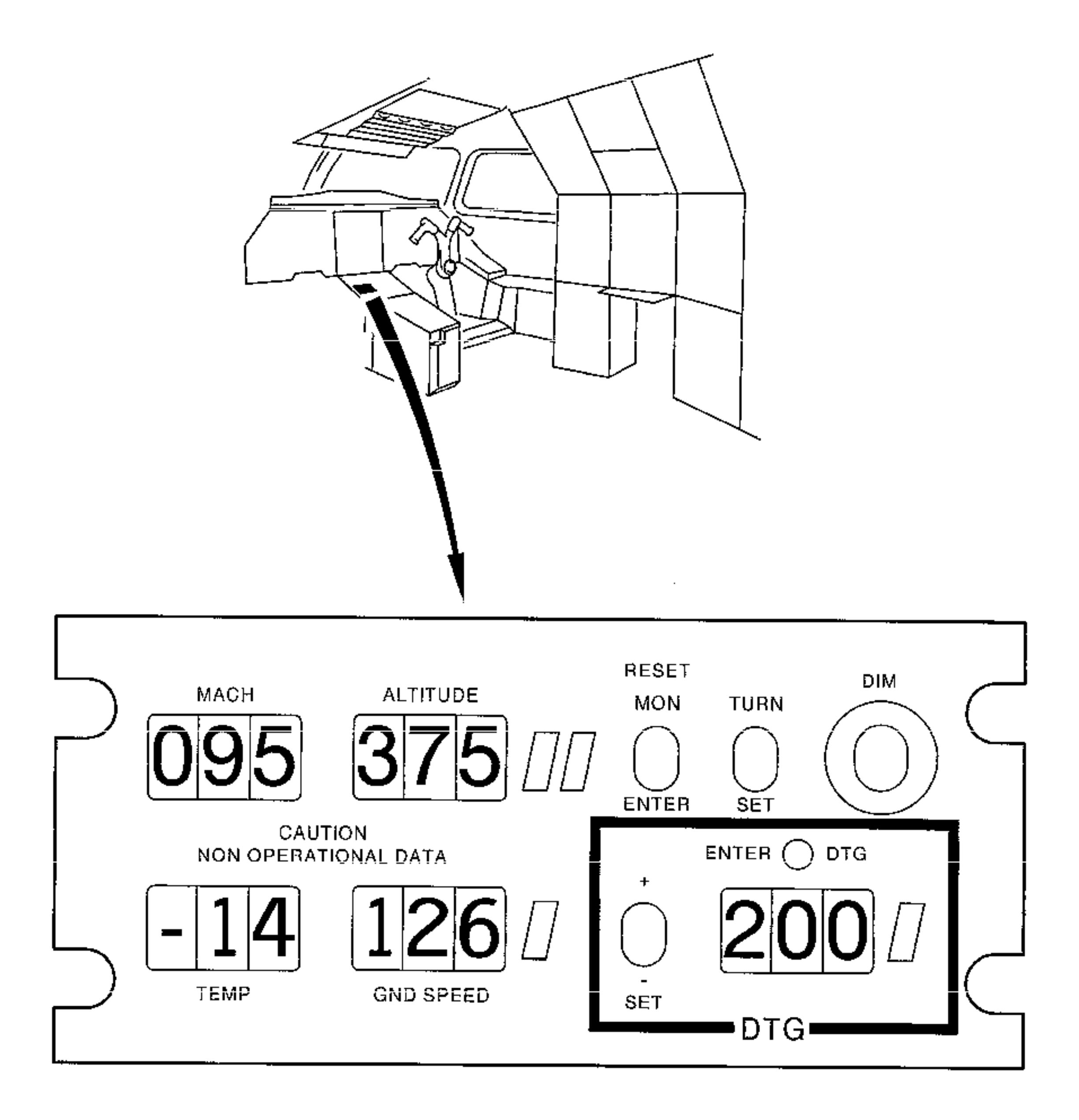


Visual Display Unit Location
Figure 401



CMB 34 11 27 40 BAM0 00

Digital Converter Box Location
Figure 402



Controller Location
Figure 403

R PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS) - ADJUSTMENT/TEST

R **ON A/C PRE MOD 34G073

1. System Functional Check

   A. Supply power and close the following breakers:

      C.B. G15 on panel 15-215. FWD LH Display 28 V d.c.
      C.B. G11 on panel 15-215. FWD RH Display 28 V d.c.
      C.B. G17 on panel 15-215. AFT LH Display 28 V d.c.
      C.B. G13 on panel 15-215. AFT RH Display 28 V d.c.
      C.B. A20 on panel 15-216. Converter 28 V d.c. supply.
      C.B. F13 on panel 13-216. Converter 26 V a.c. supply.
      C.B. F12 on panel 15-213. ADC2 28 V d.c. supply.
      C.B. F13 on panel 13-216. ADC2 115 V d.c. supply.

   B. Select the Cabin Display Switch on the FWD steward's panel to "ON".

   C. Select a DTG of 2500 on the controller and press ENTER (noting that the ENTER DTG light is illuminated). Check that when the ENTER DTG light extinguishes the controller DTG display converts to Statute miles.

   D. Check that the FWD and AFT cabin displays show a "Welcome to Concorde" message and a plan view of Concorde.

   E. Check brightness of each individual plasma panel (2 per display) by turning adjusting potentiometers on back of units, fully clockwise. Adjust the brighter panels to the dimmest in the group of four panels (i.e. FWD and AFT cabins).

   F. In accordance with 34-11-41, Adjustment/Test, carry out and hold ADC2 Test 1. (Simulating altitude above 5000 feet). Check that the displays in FWD and AFT cabins convert to display MACH, FEET (Altitude), TEMP (S.A.T.) and MPH (ground speed) left to right across the cabin. Check also that the controller has changed to display the flight parameters.

      Select the INS 2 to ALIGN and hold the CDU "Test" button down.

      Displays and Controller should read:

         MACH = 0.63 ± 0.03
         FEET = 10000 (Altitude moves in 500 ft steps)
         TEMP = -11 ± 5
         MPH = 1020 ± 20 (may take several "refreshes" to appear)

         (Controller also reads DTG)

G. Switch off INS2 after releasing CDU test button. Release ADC test 1 and check that below 5000 ft the displays show "Thank you for flying Concorde" and the controller blanks.

H. Press SET and ENTER. Enter the DTG as in paras C and D. Carry out ADC2 "Test 2".

J. Check that displays and controller read:

MACH = 2.00
FEET = 48000 (Altitude moves in 500 ft steps)
TEMP = -46 ± 5
MPH = (INS OUTPUT IS NOT ACTIVE)

Place ADC test switch to Test 1 position.

K. Displays will blank and show plan view of Concorde with horizontal bars under Mach and/or Alt. (The rate of ADC change causes the monitor to trip). Shortly afterwards (when ADC change rate reduces) the controller horizontal bars flash with the displays still showing a plan view of Concorde. After 5 minutes the displays and controller revert to:

MACH = 0.63 ± 0.03
FEET = 10000
TEMP = -11 ± 5
MPH = (INS OUTPUT IS NOT ACTIVE)

L. Switch the ADC test switch to Test 2 and when the displays have settled reswitch to the Test 1 position. When the horizontal bars flash on the controller press RESET MON and check that the displays and the controller revert to the flight parameters.

M. Press TURN and ENTER on the controller and check that displays show a plan view of Concorde and the controller blanks and the ENTER DTG light illuminates.

N. Switch off ADC Test 1 and remove power. Switch off Cabin Display system.

<u>NOTE</u>: The Cabin Display system is not a calibrated system and should never be used for cross checking or fault finding on any other system.

PASSENGER FLIGHT INFORMATION DISPLAY SYSTEM (PFIDS)
- ADJUSTMENT/TEST

** ON A/C POST MOD 34G073

1. Operational Test

A. Supply power and close the following breakers:

C.B. G15 on panel 15-215. FWD LH Display 28 V d.c.
C.B. G11 on panel 15-215. FWD RH Display 28 V d.c.
C.B. G17 on panel 15-215. AFT LH Display 28 V d.c.
C.B. G13 on panel 15-215. AFT RH Display 28 V d.c.
C.B. A20 on panel 15-216. Converter 28 V d.c. supply.
C.B. F13 on panel 13-216. Converter 26 V a.c. supply.
C.B. F12 on panel 15-213. ADC2 28 V d.c. supply.
C.B. F13 on panel 13-216. ADC2 115 V d.c. supply.

B. Select the Cabin Display Switch on the fwd steward's panel to "ON".

C.

(1) On the controller, wait until the ENTER DTG green LED is illuminated.

(2) Use the +/- button to adjust the figure displayed until it reads 4500.

(3) Press ENTER.

The left hand screens on all the individual units will now display test data. Observe the front, right hand display, this is the master unit. The display should read:

Display Diagnostics

Master Box
Righthand Box

MACH = xxx
ALT = xxx
TEMP = xxx
MACH = xxx
DTG = xxx

No serial data

Sensor data from Digital Controller

MPH = xxx
ALT = xxx
TEMP = xxx
MACH = xxx

The first group of data shown is the processed data that will or is being displayed.

The second group of data being displayed is raw data as received in BCD form from the converter on the aircraft. This is valuable when carrying out engineering checks on the ground.

D. To exit the BITE operation:

(1) On the controller, press ENTER and RESET switch simultaneously. Wait a few seconds.

(2) Using the display power switch located in the entrance vestibule of the aircraft, switch the displays OFF.

2. System Functional Check

A. Supply power and close the following breakers:

C.B. G15 on panel 15-215.	FWD LH Display 28 V d.c.
C.B. G11 on panel 15-215.	FWD RH Display 28 V d.c.
C.B. G17 on panel 15-215.	AFT LH Display 28 V d.c.
C.B. G13 on panel 15-215.	AFT RH Display 28 V d.c.
C.B. A20 on panel 15-216.	Converter 28 V d.c. supply.
C.B. F13 on panel 13-216.	Converter 26 V a.c. supply.
C.B. F12 on panel 15-213.	ADC2 28 V d.c. supply.
C.B. F13 on panel 13-216.	ADC2 115 V d.c. supply.

B. Select the Cabin display switch on the FWD steward's panel to "ON".

C. Select a DTG of 2500 on the controller and press ENTER (noting that the ENTER DTG light is illuminated). Check that when the ENTER DTG light extinguishes the controller DTG display converts to Statute miles.

D. Check that the FWD and AFT cabin displays show a "Welcome to Concorde" message and a plan view of Concorde.

E. Check brightness of each individual plasma panel (2 per display) by turning adjusting potentiometers on back of units, fully clockwise. Adjust the brighter panels to the dimmest in the group of four panels (i.e. FWD and AFT cabins).

F. In accordance with 34-11-41, Adjustment/Test, carry out and hold ADC2 Test 1. (Simulating altitude above 5000 feet). Check that the displays in FWD and AFT cabins convert to display MACH, FEET (Altitude), TEMP (S.A.T.) and MPH (ground speed) left to right across the cabin. Check also that the controller has changed to display the flight parameters.

Select the INS2 to ALIGN and hold the CDU "Test" button down.

Displays and controller should read:

MACH = 0.63 ± 0.03
FEET = 10000 (altitude moves in 500 ft steps)
TEMP = -11 ± 5
MPH = 1020 ± 20 (may take several "refreshes" to appear

(controller also reads DTG)

G. Switch off INS2 after releasing CDU test button. Release ADC Test 1 and check that below 5000 ft the displays show "Thank you for flying Concorde" and the controller blanks.

H. Press SET and ENTER. Enter the DTG as in paras C and D. Carry out ADC2 "Test 2".

J. Check that displays and controller read:

MACH = 2.00
FEET = 48000 (Altitude moves in 500 ft steps)
TEMP = -46 ± 5
MPH = (INS OUTPUT IS NOT ACTIVE)

Place ADC test switch to Test 1 position.

K. Displays will blank and show plan view of Concorde with horizontal bars under Mach and/or Alt. (The rate of ADC change causes the monitor to trip). Shortly afterwards (when ADC change rate reduces) the controller horizontal bars flash with the displays still showing a plan view of Concorde. After 5 minutes the displays and controller revert to:

MACH = 0.63 ± 0.03
FEET = 10000
TEMP = -11 ± 5
MPH = (INS OUTPUT IS NOT ACTIVE)

L. Switch the ADC test switch to Test 2 and when the displays have settled reswitch to the Test 1 position. When the horizontal bars flash on the controller press RESET MON and check that the displays and the controller revert to the flight parameters.

M. Press TURN and ENTER on the controller and check that displays show a plan view of Concorde and the controller blanks and the ENTER DTG light illuminates.

N. Switch off ADC Test 1 and remove power. Switch off Cabin Display system.

NOTE: The Cabin Display system is not a calibrated system and should never be used for cross checking or fault finding on any other system.

ADC CONTROL PANEL - REMOVAL/INSTALLATION

1. General

Removal of ADC control panel for replacement of one of the components installed on this panel.
This panel is located on centre console panel 9-211. The following components are installed on the panel :

- Two ADC ON-OFF switches (1F94 and 2F94)
- Two test selector switches (1F102 and 2F102)
- Two TEST caption lights (1F89 and 2F89)
- An ADC1 caption light (1F95) and an ADC2 caption light (2F95).

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	

B. Prepare

(1) On centre console panel 9-211, on ADC control panel, make certain that

(a) ADC1 and ADC2 switches are in OFF position.

(b) test selector switches are in NORM position.

(2) On centre console panel 9-211, make certain that LIGHTS LO-HI-TEST switch is in HI position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH UC WEIGHT SW "A" SYS	1-213	G 292	M17
SUP ADC1 28V SUP		1F 74	P12
ADS1 PROBE HTRS IND		1H 2	K 9
ADC1 26V SUP	2-213	1F 78	A 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
1ST PLT VSI SUP		1F 97	A 3
1ST PLT ADC INST SUP		1F 75	B 3
ADC1 115V SUP		1F 73	F 3
ADS2 PROBE HTRS IND	3-213	2H 2	A12
RH U/C WEIGHT SW "B" SYS SUP		G 294	B 9
FLT TEST 115VAC SUP	4-213	X 481	B22
ADC2 28V SUP	5-213	2F 74	F12
PLT'S LT TEST SUP	15-215	L1001	E14
2ND PLT ADC INST SUP	13-216	2F 75	A14
2ND PLT VSI SUP		2F 97	B13
FLT TEST 26VAC SUP		X 480	B18
ADC2 26V SUP		2F 78	F14
ADC2 115V SUP		2F 73	F15

C. Remove (Ref. Fig. 401)

(1) On centre console panel 9-211 (3), loosen the four Dzus fasteners (10).

(2) Lift ADC control panel (9) vertically out of its seating (12).

(3) Disconnect rear connectors (5) and (4) from ADC1 and ADC2 connectors (2) and (1).

(4) Cap all four connectors.

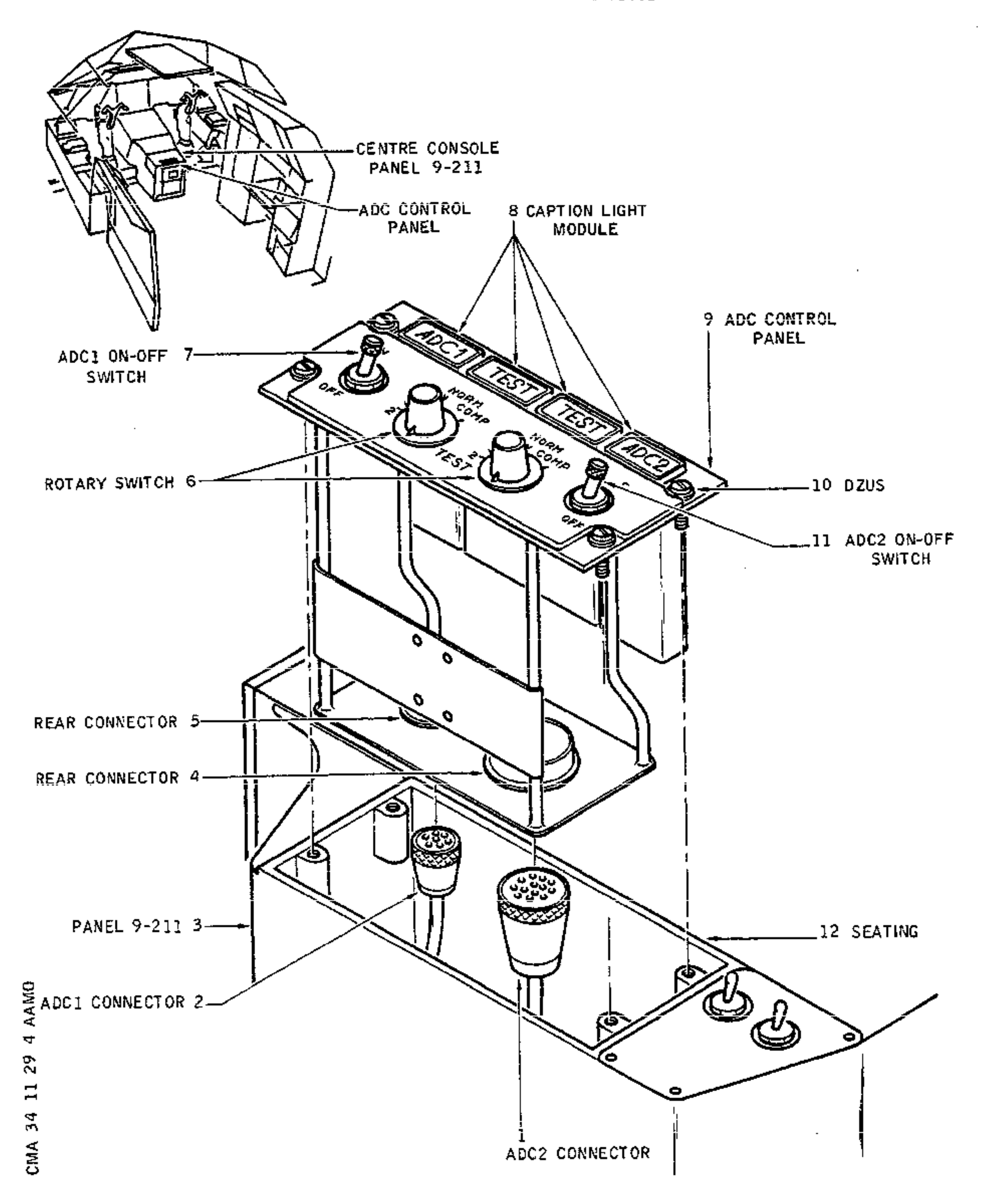
D. Preparation of Replacement component

(1) Replace of ADC ON-OFF switch (7) or (11) (Ref. 33-00-00 or 33-10-00, Removal/Installation).

(2) Replacement of test selector switch (6) (Ref. 33-00-00 or 33-10-00, Removal/Installation).

(3) Replacement of TEST or ADC1 or ADC2 caption light (8) (Ref. 33-00-00, Removal/Installation).

E. Install



ADC Control Panel - Removal/Installation
Figure 401

(1) Remove blanking caps from the four connectors.

(2) Connect rear connectors (4) and (5) to ADC1 and ADC2 connectors (2) and (1).

(3) Lower ADC control panel (9) vertically and position in seating (12).

(4) Tighten the four Dzus fasteners (10) in centre console panel 9-211 (3).

F. Test

(1) Remove safety clips and tags and reset circuit breakers tripped in paragraph 2. B. (3).

(2) Carry out an operational test of the normal air data system (Ref. 34-11-00, Adjustment/Test).

SENSING - DESCRIPTION AND OPERATION

1. General

Local parameter values of static and total pressure, temperature
R and angle of attack are taken by sensors in the aircraft.
R They are required for the development of air data information
R (altitude, airspeed, mach number, angle of attack) by the ADC
R computers.

2. Description of Sensors

A. The sensors described in the following paragraphs are installed on the fuselage and droop nose, and include :

(1) Angle of attack sensors

(2) Total temperature sensors

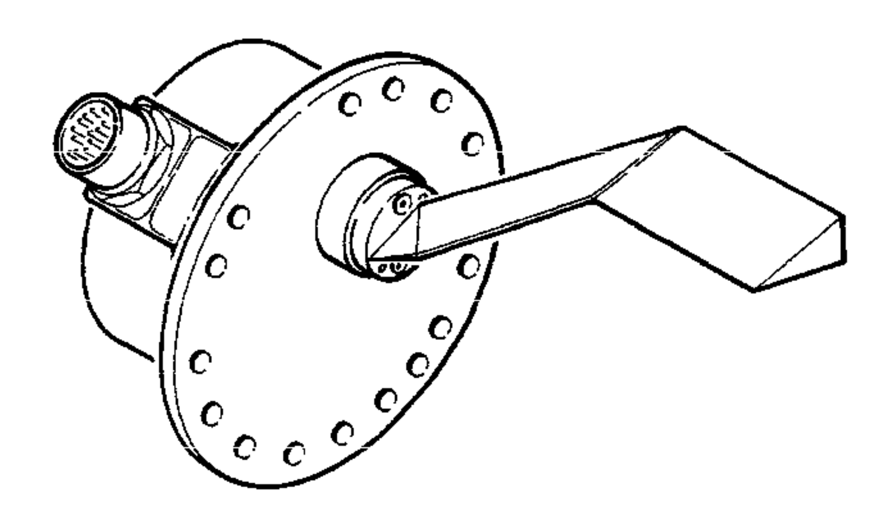
(3) Fuselage mounted pitot probes

(4) Static ports

B. All the sensors are electrically de-iced by means of controls located on flight compartment panel 4-211 (Ref. 30-00-00).

3. Sensor - Angle of Attack

A. General (Ref. Fig. 001)



CMA 34 11 30 0 AAM0

Angle of Attack Sensor - General View
Figure 001

The transducer is a precise instrument for wind measurement. It measures the angle formed by an airflow direction with an arbitrary reference line, and supplies output information proportional to this angle by means of potentiomenters. This output information is sent to the appropriate air data system. De-icing is achieved by a heating element incorporated in the transducer vane and supplied by 115 VAC. The sensors (1F91 and 2F91) are installed in zones 113 and 114.

B. Description - Operation

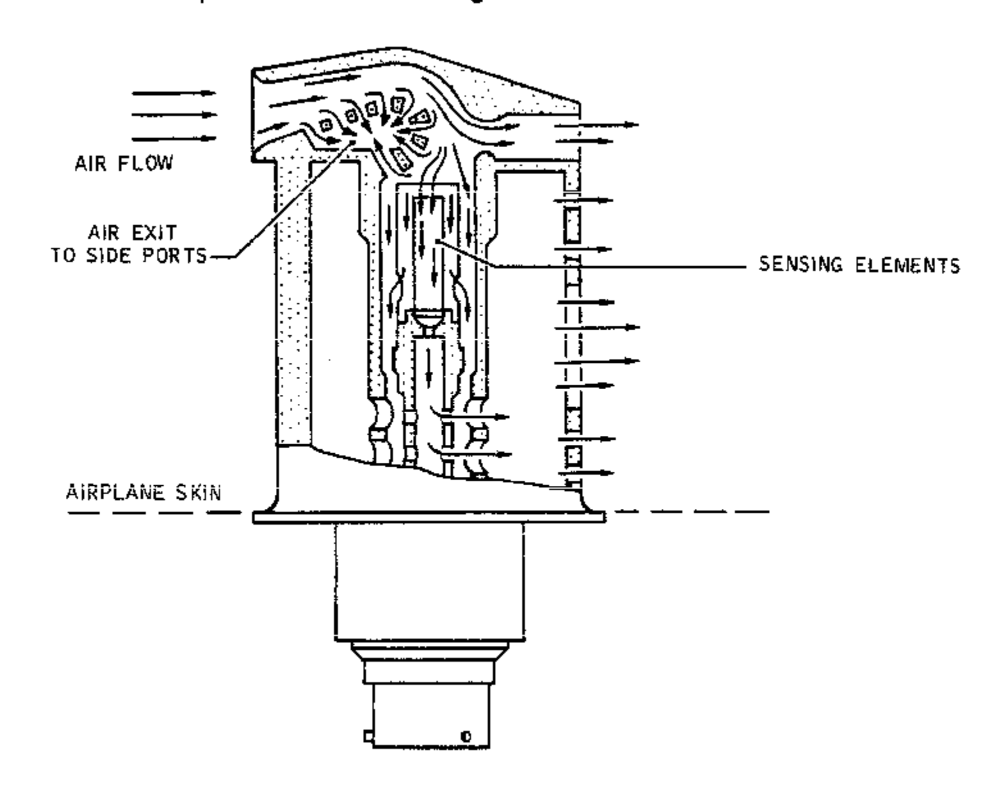
The transducer elements are built into a case. When an angle of attack change occurs, the vane (outside the case), by rotation, changes the position of the potentiometer sliders, thus generating output information.

4. Probe - Heated Total Temperature

A. General

The heated total temperature probe is an airflow pick-up which by means of a sensitive detector element, transmits temperature information to an indicator. The sensors (1F98 and 2F98) are mounted under the fuselage in zones 113 and 114 respectively.

B. Description (Ref. Fig. 002)



CMA 34 11 30 0 ACM0

Heated Total Temperature Probe : Cut-Away View
Figure 002

The total temperature probe is a dual sealed element composed of two platinum resistors. It is designed to provide accuracy of measurement necessary for high performance aircraft, allowing for a very small error due to heating.
The de-icing system is supplied from an automatically controlled 115 VAC source and in flight, dissipated power is 260 watts.
The sensitive elements are protected from foreign particles

(hail, insects, etc) by an indirect intake.

C. Operation

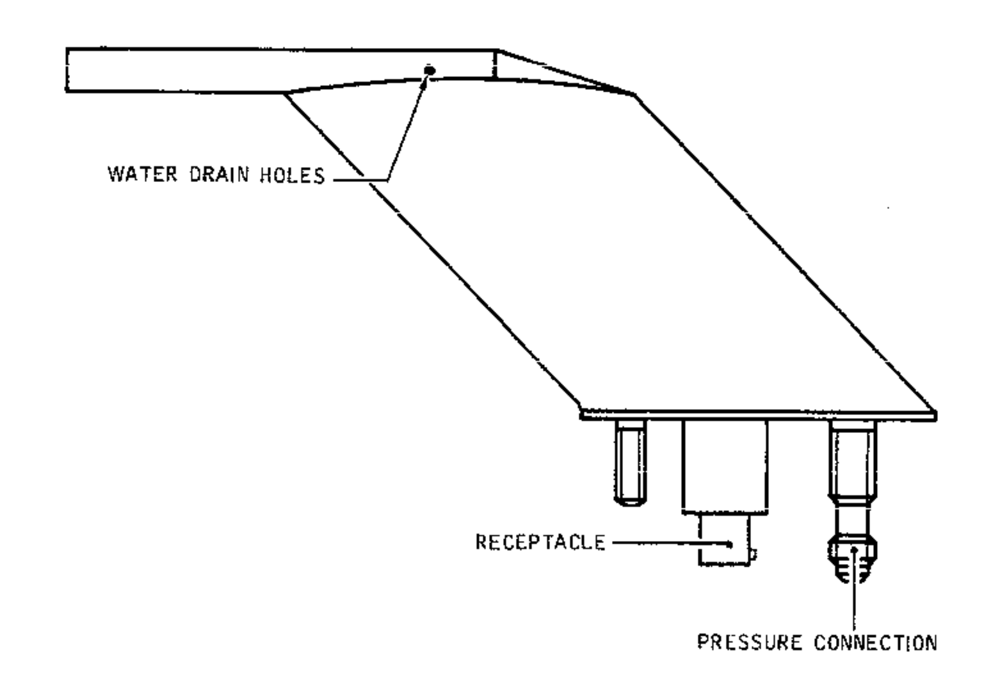
The air is channeled at right angles from the intake to circulate around the detector element in which temperature is measured. The airflow around the element causes variation of its resistance as a function of temperature. In the tube the airspeed around the element is precision damped. The de-icing device maintains the sensor free of ice in the most severe icing conditions.

5. Pitot Head - Fuselage Mounted

A. General

The pitot head is a dynamic pressure sensor which transfers dynamic pressure to the air data systems.
The ADC computers use this pressure information for calculation of calibrated airspeed. The pitot heads (1H16 and 2H16) are mounted in zones 113 and 114 respectively.

B. Description (Ref. Fig. 003)



Pitot Head - General View
Figure 003

The pitot head is designed for a high performance aircraft. The pitot tube intake is calculated to provide an accurate pitot pressure measurement at angles of attack and yaw encountered at its position on the aircraft. The pitot tube and mounting stub are protected against icing by electrical heating from a 115 VAC source. The heating is automatically controlled, so that dissipated power is inversely proportional to ambient temperature.
Heating power dissipated in flight does not exceed

480 watts, operation at an ambient temperature of 20°C reduces power to less than 260 watts. The tube has an indirect intake to avoid entry of particles into the system. It is drained by two ports.

C. Operation

Dynamic pressure is transmitted from the pitot intake, via an indirect intake to a plenum chamber in the stub. Tube and stub heating is provided by 115 VAC single-phase power. Each pitot head sends pressure information to the corresponding air data system.

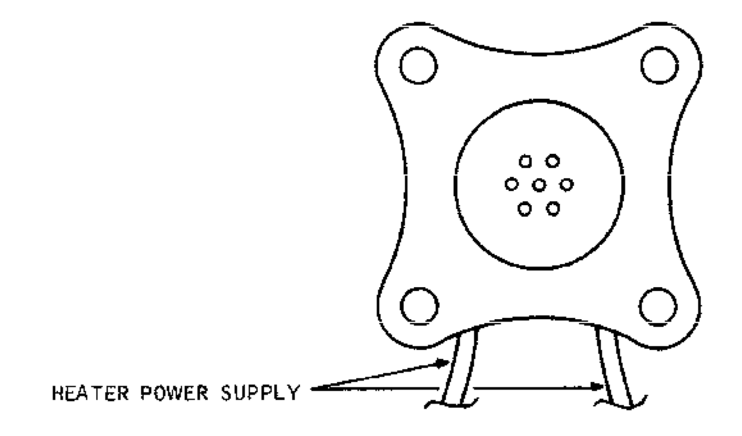
6. Static Ports - ADS Heated

A. General

The static ports supply ambient pressure to the air data systems. The pressure information is fed to the air data computers and enable computation of Hp and Vc flight parameters.

The static ports (1H19-2H19) (1H20-2H20), are installed in zones 123 and 124 respectively, on the sides of the fuselage near the forward doors.

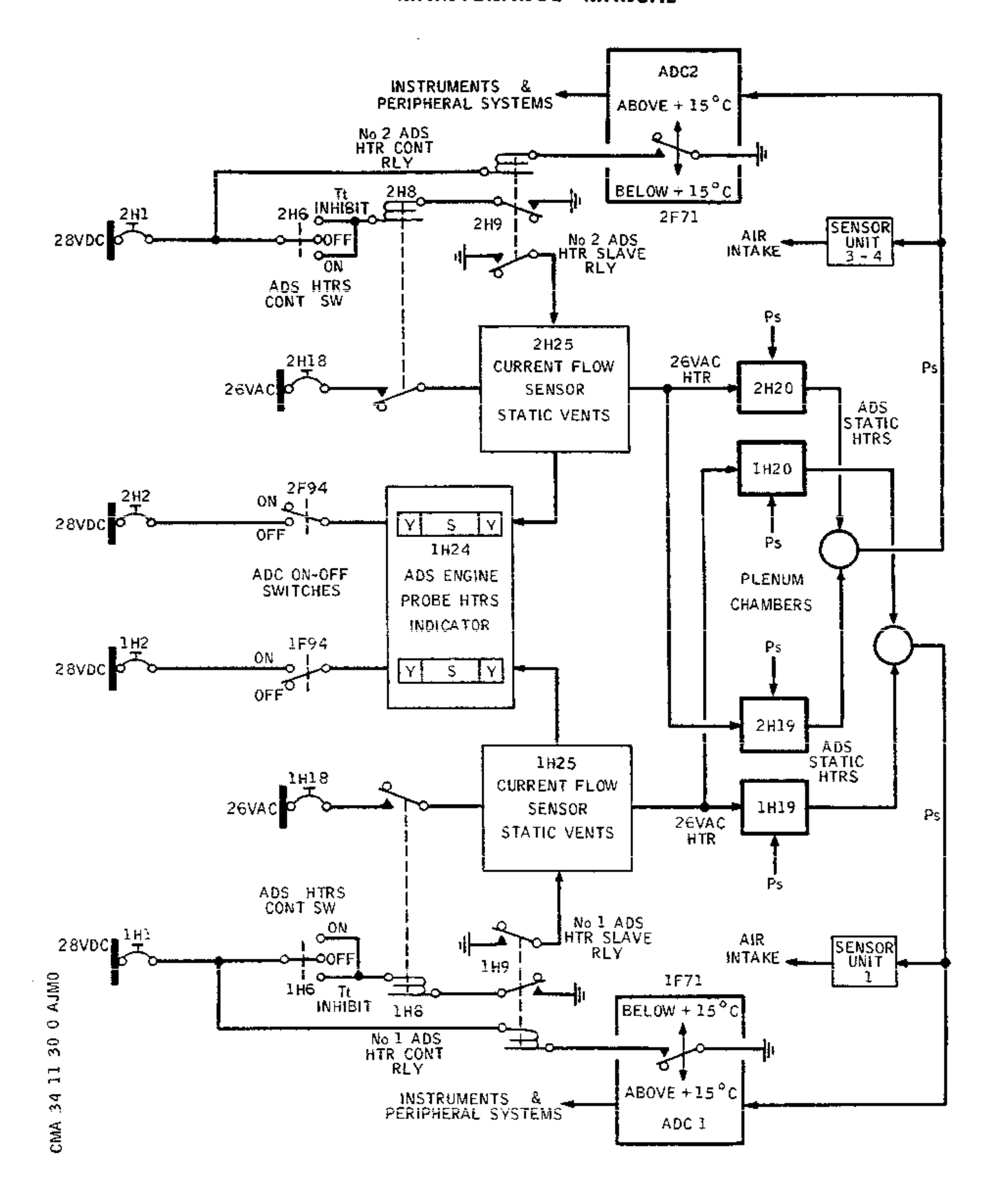
B. Description (Ref. Fig. 004)



Static Port : Front View
Figure 004

The static ports consist of small apertures which enable ambient pressure information to be obtained. They are protected against ice formation by 26 VAC electrical de-icing systems.

R C. Operation (Ref. Fig. 005)



Static Ports and Heating System Block Diagram
Figure 005

R

(1) Static ports

To eliminate the effects of sideslip, information from the two static ports at each side of the fuselage (1H19-1H20) and (2H19-2H20) is averaged in an expansion chamber. It is then sent to the ADC and to the pressure transmitters of the engine air intake control system.

The Captain pressure system supplies :

- ADC 1 computer (1F71) which supplies information to the Captain instrument and systems.
- A pressure transmitter (sensor unit 1).

The First Officer pressure system supplies :

- ADC computer (2F71) which supplies information to the First Officer instruments, and systems.
- Two pressure transmitters (sensor units 3 and 4).

(2) Heating

As the heating systems are identical only system 1 heating will be described.

With circuit breakers (1H18) and (1H1) set and switch (1H6) in ON or Tt INHIBIT position, the heating system operates when ADC 1 (1F71) detects total temperature (Tt) lower than 15°C.

Relay (1H9) is energized through circuit breaker (1H1) and causes :

- Application of a ground connection to unit (1H25) which causes illumination of warning light (1H24) in case of a break in a heating resistance element.
- Energization of relay (1H8) through switch (1H6) and circuit breaker (1H1). The relay connects 26 VAC power to static port (1H19) and (1H20) via the static vents current from sensor unit (1H25). This voltage holds off S warning light on ADS engine probe heaters indicator unit, on panel 4-211.
  The warning light is supplied from circuit breaker (1H2) when the system is energized.

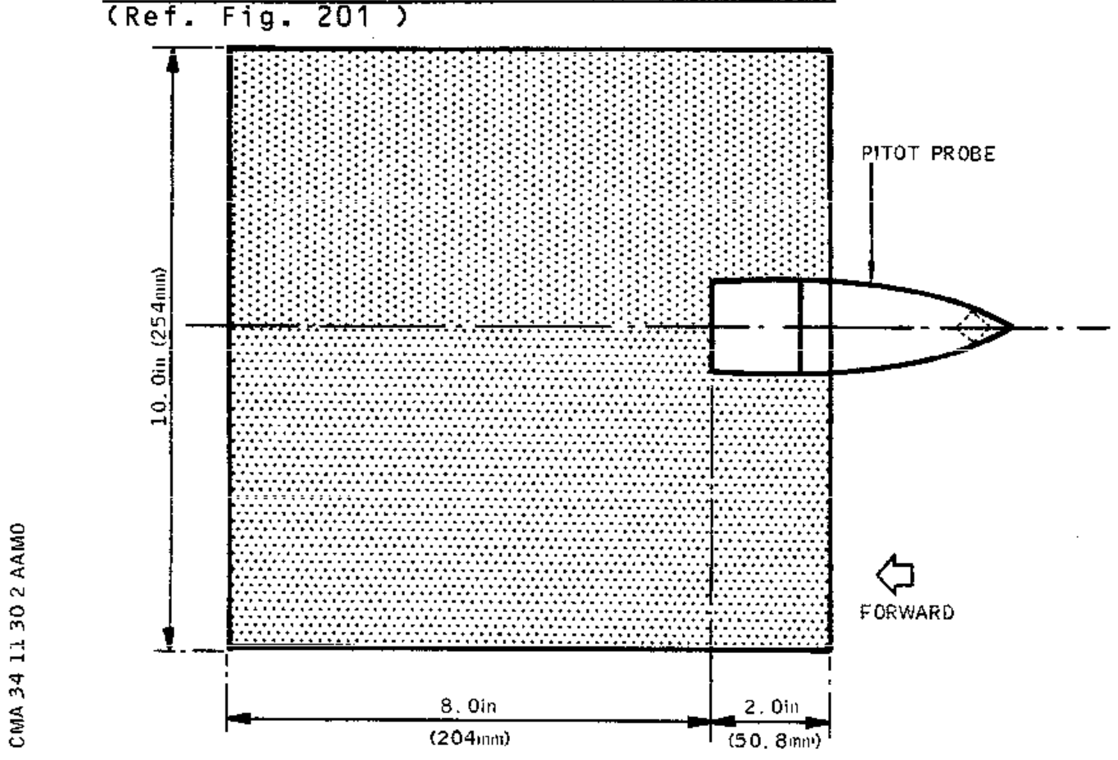
SENSING - MAINTENANCE PRACTICES

1. General

The areas around the fuselage mounted pitot probes, incidence and side slip sensors are designated as special areas.
Any damage or irregularities in these special areas will affect readings of Mach Number, airspeed and altitude, and will also affect the operation of the intake control system.

Damage to these special areas must be reported, recorded and appropriate rectification action taken.

2. Pitot Heads - Area Damage Limitations.
(Ref. Fig. 201)



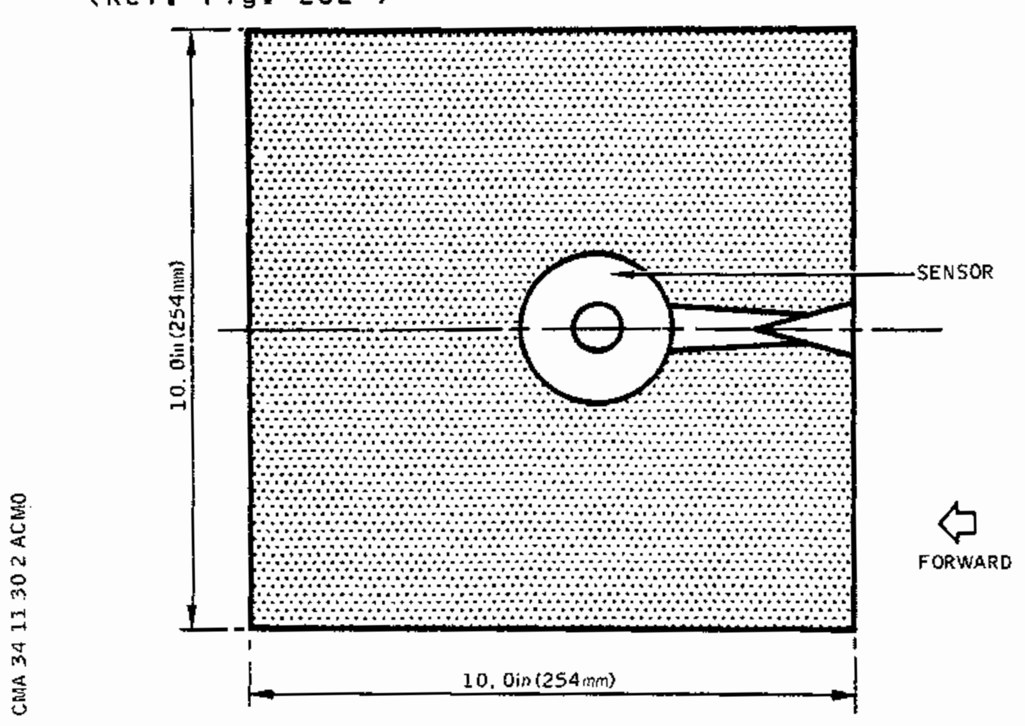
Pitot Probe Special Areas
Figure 201

The special areas for pitot head installations are shown on the Figure.

Scores and scratches of a maximum depth of 0.02 ins (0.5 mm)

are allowed, provided that all protruding burrs are removed. Blending out is permitted in these areas providing the restrictions and procedures as listed in the Structure Repair manual 53-30-00 are complied with.

3. Sensors - Area Damage Limitations
(Ref. Fig. 202)



Sensors - Special Areas
Figure 202

The special areas for sensor installations are shown on the Figure.

Scores and scratches of a maximum depth of 0.02 ins (0.5 mm) are allowed, provided that all protruding burrs are removed. Blending out is permitted in these areas providing the restrictions and procedures as listed in the Structure Repair manual 53-30-00 are complied with.

ANGLE OF ATTACK SENSOR - REMOVAL/INSTALLATION

1. General

Removal for exchange or check. The two sensors are identical, the sensor for air data system (1F91) is in zone 113, that of air data system 2 (2F91) in zone 114.

NOTE : The angle of attack sensors are electrically heated for de-icing purposes. If they are switched on when the aircraft is on the ground they get HOT. Before any maintenance work is carried out in the immediate vicinity of these vanes, it must be checked that the relevant sensor heating supply is switched off, and a "DO NOT OPERATE" sign is placed on the relevant heater control switch. Ground operation of the heaters should be kept to a minimum. Heaters should only be operated on the ground during Maintenance when checking the function of the current sense relays, and correct operation of the heating circuits.

2. Angle of Attack Sensors

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Platform, Height of Access 4.470 m (14 ft. 8 in.)	
Blanking Caps for Electrical Connectors	
Cover - Angle-of-Attack Sensor	D935181000
Lockwire, Dia. 0.45 mm = (0.018 in.), Z3CNT 18 annealed	
Lockwire, Dia. 1 mm = (0.040), Z3CNT 18 annealed	
Special Material (Ref. 20-30-00, No.128)	
Common Grease (Ref. 20-30-00, No.051)	

B. Prepare

(1) Make certain that droop nose is in ZERO position, visor down (Ref. 27-61-00, Adjustment/Test).

(2) For operation on angle of attack sensor (1F91)

(a) On ADC control panel, centre console 9-211, make certain that switch ADC1 ON-OFF is in OFF position.

(b) On panel 4-211, make certain that switch ADS AND ENG PROBE HEATERS, Tt INHIB-OFF-ON ADC1 is in OFF position.

(c) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS1 PROBE HTRS CONT	1-213	1H 1	K 8
ADC1 28V SUP		1F 74	P12
INCIDENCE SENSOR 1 SUP	2-213	1K1900	C14
ADC1 115V SUP		1F 73	F 3
ADS1 A/ATTACK PROBE HTR SUP		1H 5	F24

(3) For operation on angle of attack sensor (2F91).

(a) On ADC control panel, centre console 9-211, make certain that switch ADC2 ON-OFF is in OFF position.

(b) On panel 4-211, make certain that switch ADS AND ENG PROBE HEATERS, Tt INHIB-OFF-ON ADC2 is in OFF position.

(c) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS2 PROBE HTRS CONT	3-213	2H 1	A11
INCIDENCE SENSOR 2 SUP	4-213	2K1900	G17

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC2 28V SUP ADS2 A/ATTACK	5-213	2F 74	F12
PROBE HTR SUP	13-216	2H 5	D12
ADC2 115V SUP		2F 73	F15

(4) Position access platform beside sensor to be removed.

(5) Remove protection covers from angle of attack sensors (equipment D935181000), if fitted.

(6) Open access panel 113BB.

WARNING : CARE MUST BE TAKEN ON REMOVAL OF ANGLE OF ATTACK OR SIDE SLIP SENSOR UNITS PRIOR TO FITTING REPLACEMENTS THAT ONLY THE FOUR WIRELOCKED BOLTS ARE RELEASED. DISTURBANCE OF THE NUTS OF THE OTHER SIX BOLTS WILL INVALIDATE SENSOR UNIT ALIGNMENT.

C. Remove (Ref. Fig. 401)

(1) Disconnect electrical connector (1). Fit blanking caps.

(2) Cut and remove lockwire, remove four screws (2).

(3) Remove angle of attack sensor assembly (3) from inner plate (7).

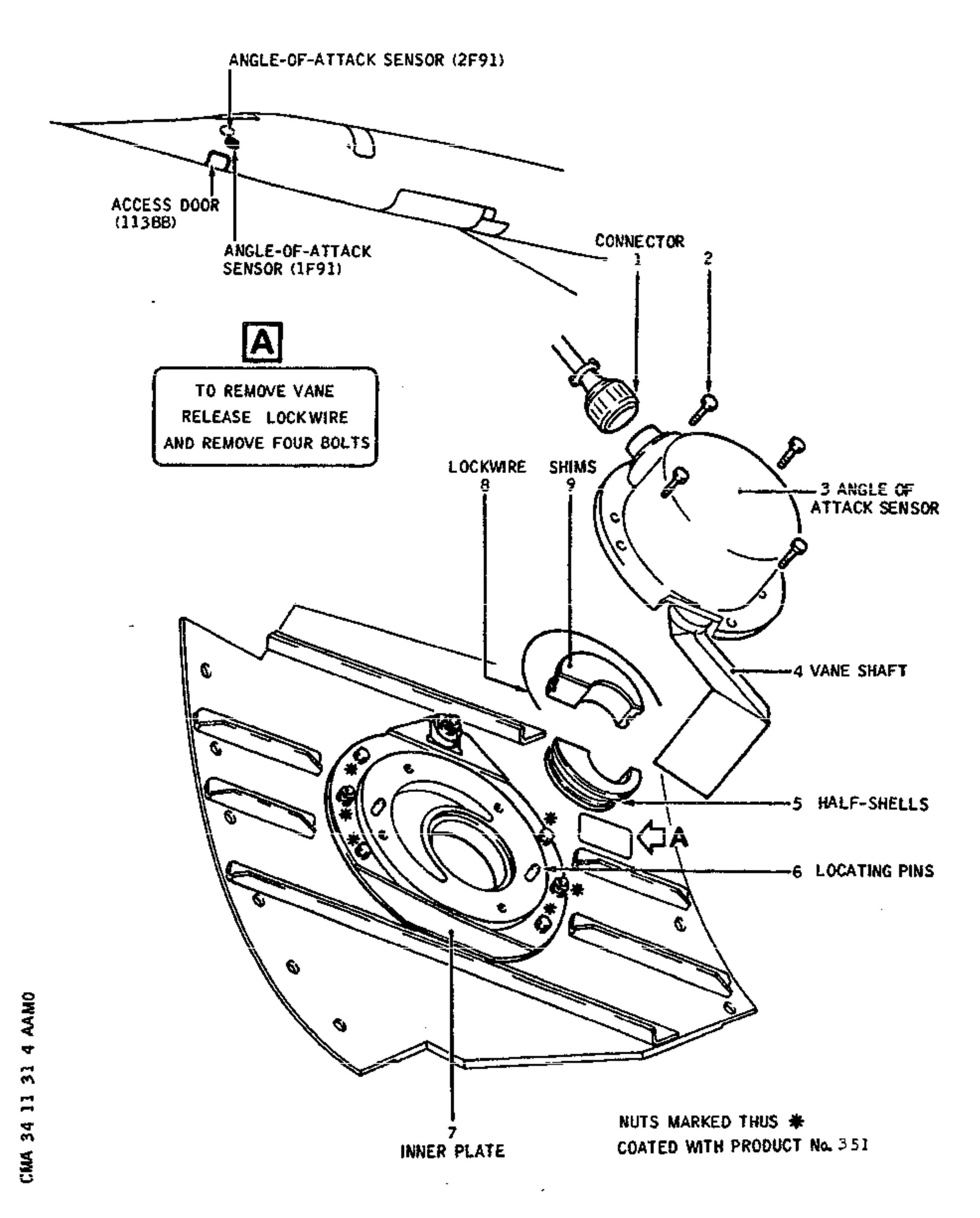
CAUTION : DURING THIS OPERATION TAKE CARE NOT TO DAMAGE SENSOR VANE.

(4) Remove lockwire (8) from two half-shells (5) of plug, retain shells with their shims (9).

D. Preparation of Replacement Component

(1) On aircraft, make certain that sensor mounting location and inner plate (7) are clean, and that the label TO REMOVE VANE RELEASE WIRE LOCKING AND REMOVE FOUR BOLTS is in position.

(2) Make certain that sensor (3) base and plug half-shells (5) are clean.



R Angle of Attack Sensor - Removal/Installation
Figure 401

(3) Make certain that shims (9) are bonded to plug half-shells (5).

E. Install
(Ref. Fig. 401)

(1) Coat with product No.051 interior surfaces of half-shells (5) install half-shells around vane shaft (4) using lockwire (8) diameter 0.45 mm (0.018 in.).

(2) Coat with product No.051 angle of attack sensor base, locating pins (6) and screws (2).

(3) Position angle of attack sensor assembly correctly with respect to locating pins (6) on inner plate (7) taking care not to damage vane during this operation.

(4) Install four screws (2), wirelock using 1 mm (0.040 in.) diameter lockwire.

R (5) Coat six attachment nuts with product No.351.

(6) Remove blanking caps, connect electrical connector (1).

F. Tests

(1) Make certain that the following circuit breakers are tripped :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS1 PROBE HTRS CONT	1-213	1H 1	K 8
ADS1 A/ATTACK PROBE HTR SUP	2-213	1H 5	F24
ADS2 PROBE HTRS CONT	3-213	2H 1	A11
PROBE HTR SUP	13-216	2H 5	D15

(2) Droop nose is in 0° position. Access platform remains in position beside sensor to be tested. The sensors are identical and test procedure is described for ADC1 system sensor 1F91. For system 2 test (ADC2, sensor 2F91) substitute equipment numbers in parentheses.

(3) Place ADC1 (ADC2) in operation (Ref. 34-11-00, Adjustment/Test).

(4) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
(LH UC WEIGHT SW "A" SYS SUP)	1-213	(G 292)	(M17)
RH UC WEIGHT SW "B" SYS SUP	3-213	G 294	B 9

to simulate on the ground flight condition which per= mits cancellation of inhibit due to Vc less than 95 kts.

(a) Turn angle of attack sensor 1F91 (2F91) vane to upper or lower stop and check that for a droop nose configuration of 0° or 12.5°, reading on angle of attack indicator for the appropriate sensor stop is in accordance with the following table :

ANGLE OF ATTACK SENSOR VANE/ DROOP NOSE	0°	12.5°
UPPER STOP	INDICATOR 22.5° ± 1°	INDICATOR
LOWER STOP		- 1° ± 1°

(4) Carry out angle of attack sensor heater tests (Ref. 30-31-00, Adjustment/Test).

G. Close-Up

(1) Shut down ADC system in operation (Ref. 34-11-00, Adjustment/Test).

(2) Close access door 113BB.

(3) Install protection covers (equipment D935181000).

(4) Remove access platform.

RB

ANGLE OF ATTACK SENSOR - INSPECTION/CHECK

1. General

This is an in situ check to monitor the condition of the bearings damping mechanism and potentiometer drive.

A. Ensure incidence (angle of attack) system is not in use and that the vane heater is OFF.

B. Check vane statically, there should be no side or end play on the bearings. There should be no evidence of misalignment or damage to the vane.

C. Move vane slowly between the limits of its travel. Movement should be of uniform smoothness throughout its range. Repeat in reverse direction. There should be no perceptible backlash in the drive.

D. With vane in normal position measure the force required to rotate it. Force applied at trailing edge of vane should
RB be less than 12 grams.
RB

TOTAL TEMPERATURE SENSOR - REMOVAL/INSTALLATION

1. General

Removal for exchange or check. The two sensors are identical, air data system 1 sensor (1F98) is in zone 113, air data system 2 sensor (2F98) is in zone 114.

2. Total Temperature Sensor

A. Equipment and Materials

DESCRIPTION	PART NO.
Platform, Height of Access 3.972 m (13 ft.)	
Blanking Cap for Sensor Seating	
Blanking Caps for Electrical Connectors	
Circuit Breaker Safety Clips	

B. Prepare

(1) For operation on sensor (1F98).

R (a) On ADC control panel, centre console 9-211, make certain that switch ADC1 ON-OFF is in OFF position
R and TEST selector switch in NORM position.

(b) On panel 4-211, make certain that switch ADS AND ENG PROBE HEATERS Tt INHIB-OFF-ON ADC1 is in OFF position.

(c) Trip safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS1 PROBE HTRS CONT	1-213	1H 1	K 8
ADC1 28V SUP		1F 74	P12
ADC1 115V SUP	2-213	1F 73	F 3
ADS1 TOTAL TEMP HTR SUP		1H 21	G24

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(2) For operation on sensor (2F98)

(a) On ADC control panel, centre console 9-211, make certain that switch ADC2 ON-OFF is in OFF position and TEST selector switch in NORM position.

(b) On panel 4-211, make certain that switch ADS AND ENG PROBE HEATERS Tt INHIB-OFF- ADC2 is in OFF position.

(c) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS2 PROBE HTRS CONT	3-213	2H 1	A11
ADC2 28 V SUP	5-213	2F 74	F12
3CM ADC TEMP INST SUP	13-216	F 105	A15
ADS2 TOTAL TEMP HTR SUP		2H 21	B11
ADC2 115 V SUP		2F 73	F15
NAV INST BUS 13XS		X 345	G 4

(3) Position access platform under droop nose.

(4) Open access door 113BB.

C. Remove (Ref. Fig. 401)

CAUTION : DELICATE EQUIPMENT TO BE HANDLED WITH CARE.

(1) Through access door (113BB), disconnect plug (6) from total temperature sensor (1) base connector (7) (1F98) or (2F98).

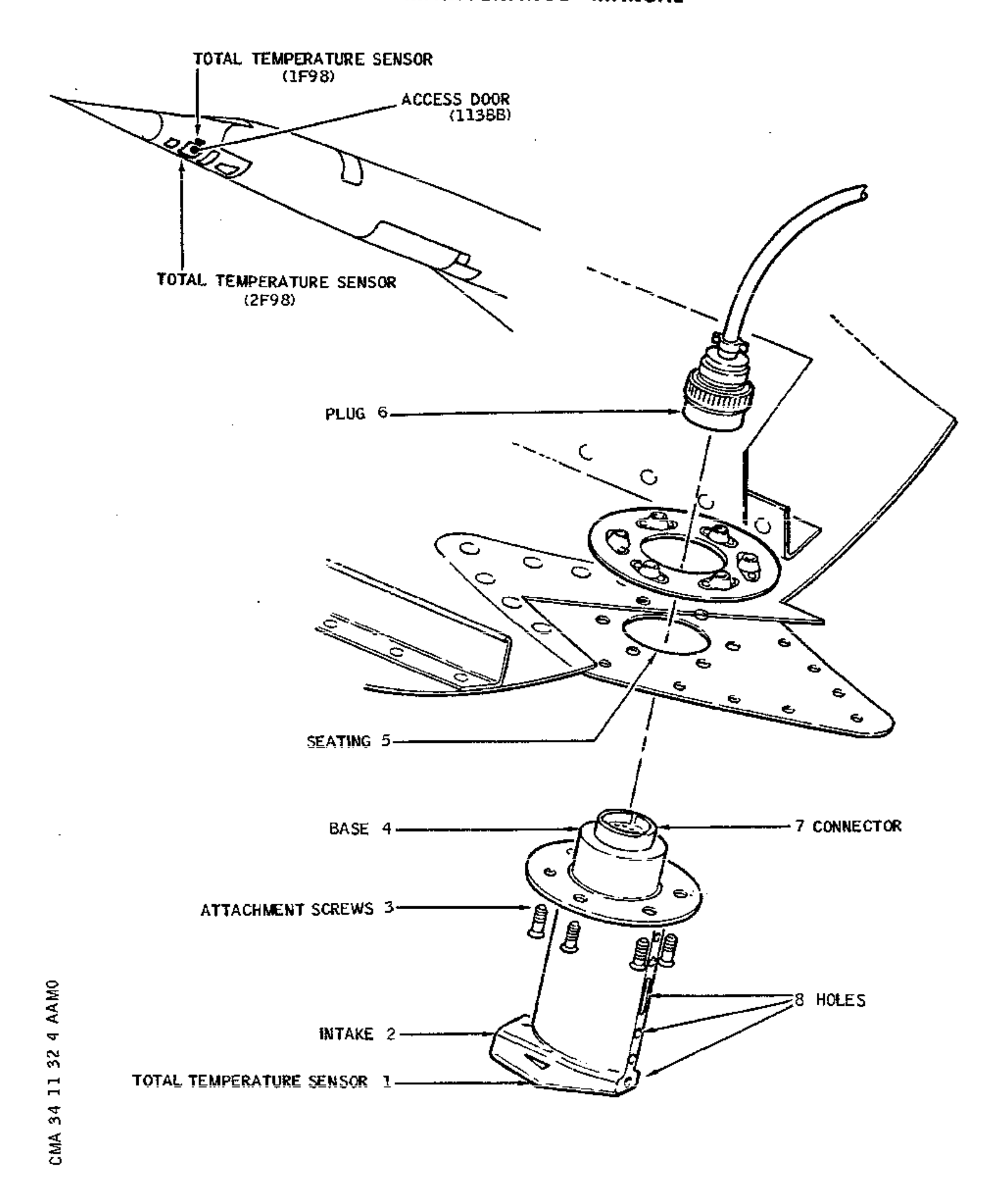
(2) Remove six attachment screws (3), holding sensor (1).

(3) Pull sensor (1) vertically to release base (4) from seating (5) on aircraft.

(4) Cap connectors and sensor seating.

D. Preparation of Replacement Component

(1) On aircraft, make certain that sensor seating (5) is clean.



Total Temperature Sensor : Removal/Installation
Figure 401

(2) Make certain :

(a) Of good external condition of sensor (1) (no serious corrosion, burrs etc.).

(b) That base electrical connector (7) shows no trace of oxydation and that pins are not damaged.

(c) That intake (2) and holes (8) are not blocked.

E. Install

(1) Remove blanking caps.

(2) Vertically position sensor (1) (intake (2) facing forwards) so that base (4) fits into seating on aircraft (5).

(3) Install six attachment screws (3) while holding sensor and tighten gently.

(4) Through access door (113BB) connect and tighten plug (6) to sensor base electrical connector (7).

F. Tests

(1) Remove safety clips and tags and reset circuit-breakers previously tripped in 2. B. (1) (c) or 2. B. (2) (c).

(2) Carry out a total temperature sensor heating test (Ref. 30-31-00, Adjustment/Test)

G. Close-Up

(1) Close access door 113BB.

(2) Remove access platform from under droop nose.

(3) On panel 13-216 trip circuit breaker NAV INST BUS 13XS X345, map ref. G4

FUSELAGE MOUNTED PITOT HEAD - REMOVAL/INSTALLATION

1. General

Removal for replacement or check. The two pitot heads are identical, the head feeding air data system 2 (2H16) is in zone 114.

B NOTE: The pitot head probe is electrically heated for de-icing
B purposes. If they are switched on when the aircraft is on
B the ground they get HOT (up to 500°C under no airflow
B conditions). Before any maintenance work is carried out in
B the immediate vicinity of these probes, it must be checked
B that the relevant heating supply is switched off, and a
B "DO NOT OPERATE" sign is placed on the relevant heater
B control switch. Ground operation of the probe heaters
B should be kept to a minimum. Heaters should only be
B operated on the ground during Maintenance, when checking the
B function of the current sense relays, and correct operation
B of the heating circuits. Pitot probe heaters MUST NOT be
B switched on under any circumstances when leak testing
B adaptors, protective covers or blanks are fitted.

2. Fuselage Mounted Pitot Heads

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Blanking cap for dynamic pressure line connector	-
Blanking cap for electrical connector	-
Platform, height of access 4.470 m (14 ft 8 in)	-
Lockwire	-
Seal - pitot head	-
Sealants (Ref. 20-30-00, No.351)	-
Fuselage mounted pitot head	-

B. Prepare

(1) For operation on head (1H16).

(a) On ADC control panel, centre console 9-211, make certain that switch ADC 1 ON-OFF is in OFF position and selector switch TEST is in NORM position.

(b) On panel, 4-211, make certain that switch ADS AND ENG. PROBE HEATERS Tt INHIB-OFF-ON-ADC1 is in OFF position.

(c) Trip, safety and tag, the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS1 PROBE HTRS CONT	1-213	1H 1	K 8
ADC1 28V SUP		1F 74	P12
ADC1 115V SUP	2-213	1F 73	F 3
ADS1 PITOT PROBE HTR SUP		1H 3	F22

(2) For operation on head (2H16).

(a) On ADC control panel, centre console 9-211, make certain that switch ADC 2 ON-OFF is in OFF position and that selector switch TEST is in NORM position.

(b) On panel 4-211, make certain that switch ADS AND ENG. PROBE HEATERS. Tt INHIB-OFF-ON-ADC2 is in OFF position.

(c) Trip, safety and tag the following circuit breakers:

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	ADS2 PROBE HTRS CONT	3-213	2H 1	A11
R	ADC2 28V SUP	5-213	2F 74	F12
	ADS2 PITOT PROBE HTR SUP	13-216	2H 3	D11
R	ADC2 115V SUP		2F 73	F15

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(3) Position access platform under droop nose.

(4) Remove fuselage mounted pitot head protection covers if fitted.

(5) Open access door 113AB.

C. Remove (Ref. Fig. 401)

(1) Disconnect and cap electrical connector (1).

(2) Remove pneumatic connector (7) disconnect dynamic pressure line, cap open line ends.

(3) Cut and remove lockwire, remove nuts (5 and 8) and washers (4 and 9).

(4) Remove pitot head (10) from mounting plate (2).

D. Preparation of Replacement Component

(1) On aircraft, make certain that pitot head mounting plate (2) is clean.

(2) Position new seal (1) in housing on mounting plate, apply product No.351 (Ref. 20-30-00, No.351).

(3) On head (10) make certain :

(a) That head has no external signs of serious corrosion or abrasions; marks caused by heating are permissible.

(b) That drainage holes are not blocked.

(c) That threads of attachment studs, pneumatic and electrical connectors are not damaged.

(d) That pneumatic connector entry is not blocked.

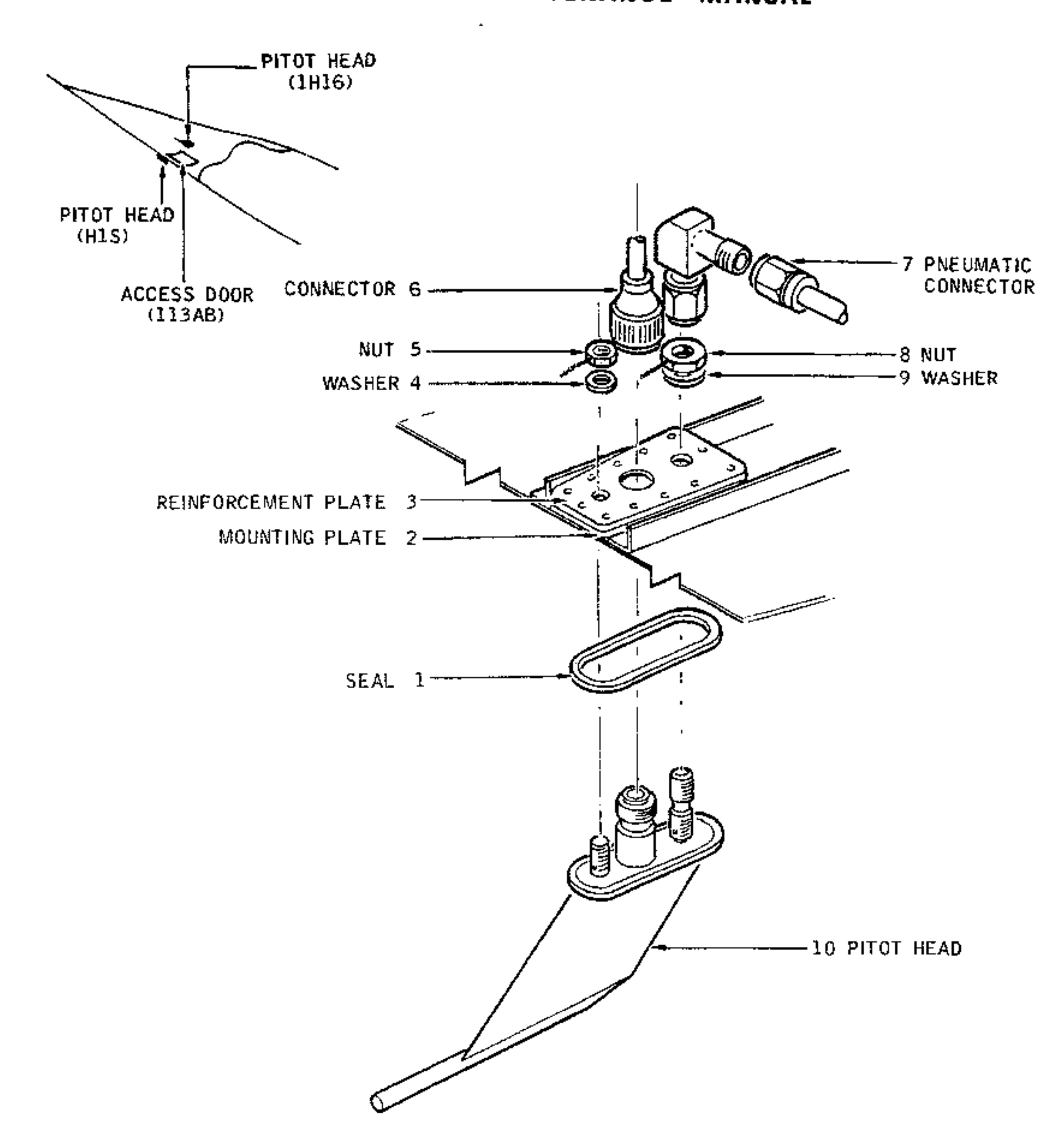
(e) That electrical connector pins are not damaged.

E. Install
R (Ref. Fig. 401)

(1) Install head (10) on mounting plate (6).

(2) Install washers (4 and 9), nuts (5 and 8), tighten nuts.

(a) Torque :



CMA 34 11 34 4 AAM0

Fuselage Mounted Pitot Head :
Removal/Installation
Figure 401

- Nut (5) 140 to 160 lbf.in. (1.55 to 1.80 m.daN)
- Nut (8) 50 to 60 lbf.in. (0.56 to 0.68 m.daN)

(b) Wirelock nuts.

(3) Remove blanking caps, install dynamic pressure line pneumatic connector (2).

(4) Remove blanking caps, connect electrical connector (1).

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in 2-B-(1)-(c) or 2-B-(2)-(c).

(2) Carry out a test of ADC 1 or ADC 2 system, (Ref. 34-11-00, Adjustment/Test).

(3) Carry out a fuselage mounted pitot head heating test (Ref. 30-31-00, Adjustment/Test).

G. Close-Up

(1) Install protection covers.

(2) Close access door (113 AB).

(3) Remove access platform from under droop nose.

R 3. Insulation and Resistance Check of Fuselage Mounted Pitot Heads

R B A. Preparation

R B (1) Ensure that ADC1 and ADC2 control switches on 9-211 are placed in the "OFF" position, "PROBE HEATER TO INHIB" ADC1 and ADC2 control switches on 4-211 are placed to "OFF".

R B (2) Trip and safety tag the following circuit breakers :

		SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
R	B	ADS1 PITOT PROBE HTR SUP	2-213	1H	3	F22
R	B	ADS2 PITOT PROBE HTR SUP	13-216	2H	3	D11

R B (3) Position access platform under droop nose, open access door 113AB to gain access to No.1 Pitot Probe (1H16),

B No.2 Pitot Probe (2H16).

B (4) Disconnect the pitot head connectors 1H16-A, 2H16-A
B (Reference wiring diagrams 30-31-12, 30-31-22).

B B. Checks

B Resistance and insulation checks must only be carried out
B on cold pitot heads.

B (1) Resistance Checks
B Using an Avometer or a similar low voltage instrument
B measure the resistance value of the heater elements of
B both heads. Measure between pitot head pins A/B/C and
B D/E/F. Note the resistance values obtained.

R B (2) Insulation Checks
R B Using a 250VDC megger, measure the insulation resis-
R B tance of both heads between pitot head pins D, E, F
R B and frame of pitot head. Note the insulation resis-
R B tance values obtained.

B C. Tests

B (1) Reconnect the pitot head connectors 1H16-A,2H16-A.

B (2) Remove safety tags and reset circuit breakers, pre-
B viously tripped in A.2.

B (3) Before carrying out this test ensure that pitot head
B covers/blancks are removed. Carry out pitot head
B heating test as per Maintenance Manual 30-31-00.

B D. Close-Up

B (1) Ensure that pitot head heaters are switched off.
B Install protective covers.

B (2) Close access door 113AB.

B (3) Remove access steps.

STATIC PORTS - MAINTENANCE PRACTICES

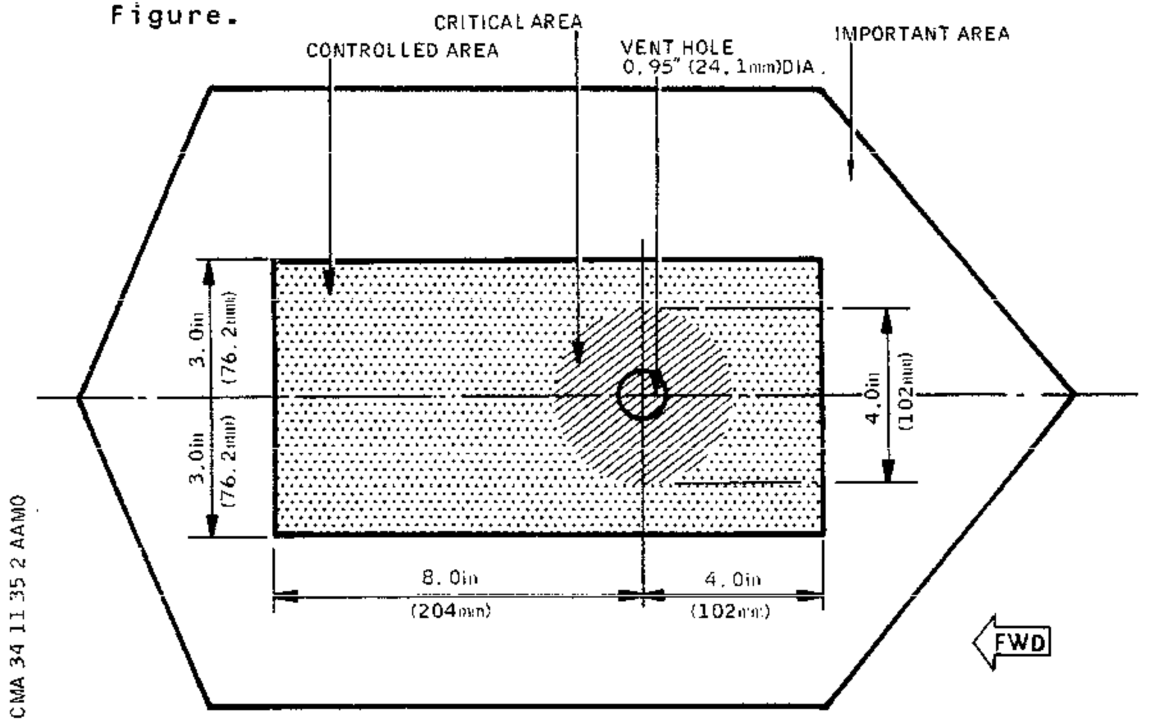
1. General

The areas around the fuselage mounted static plates are designated as special areas. Any damage or irregularities in these special areas will affect readings of Mach number, airspeed and altitude, and will also affect the operation of the intake control system.

Damage to these special areas must be reported, recorded and the appropriate rectification action taken.

2. Static Plate Damage Limitations
(Ref. Fig. 201)

The static plates are divided into a "CRITICAL AREA", "CONTROLLED AREA" and an "IMPORTANT AREA" as shown on the Figure.



Static Vent Plates - Special Areas
Figure 201

A. Critical and Controlled Area

Scores and scratches of a maximum depth of 0.02 ins (0.5 mm) are permitted, providing that they are not across the static orifices, and that all protruding burrs are removed.

Blending out of scores and scratches on static plates is not permitted.

B. Important Area

Scores and scratches of a maximum depth 0.025 (0.64 mm) are allowed, providing that all protruding burrs are removed.

Blending out of scores and scratches on static plates is not permitted.

R STATIC PORTS - REMOVAL/INSTALLATION

1. General (Ref. Fig. 401)

Removal for replacement or check.
Static ports S16 and S18 are in zone 124.
Static ports S17 and S19 are in zone 123.
Static ports S17 and S18 supply a plenum chamber which sends stabilized and equilibrated static pressure to ADC1.
Static ports S16 and S19 supply a plenum chamber which sends stabilized and equilibrated static pressure to ADC2.
The corresponding electrical identifiers are:

2H20 for port S16
1H20 for port S18
1H19 for port S17
2H19 for port S19.

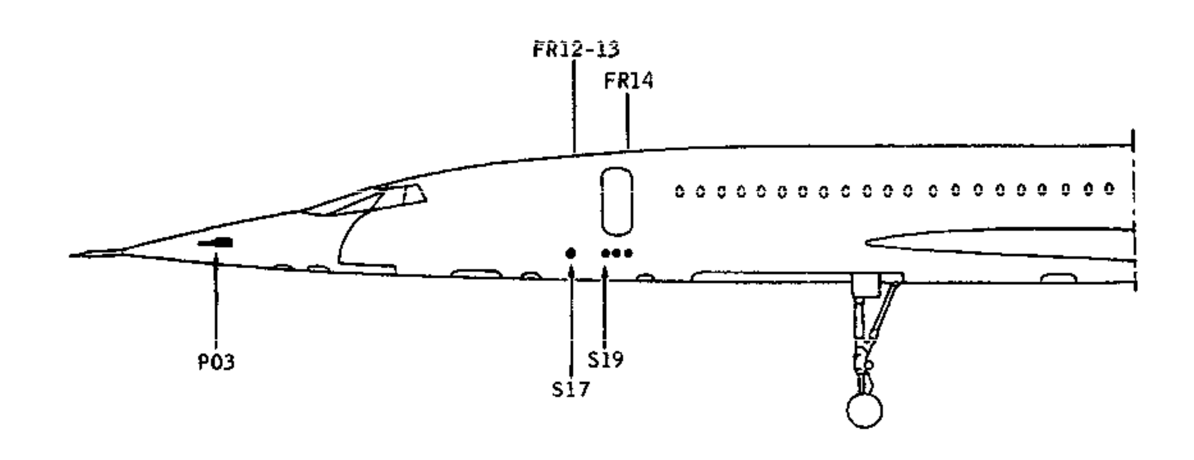
B NOTE: The static ports are electrically heated for de-icing
B purposes. If they are switched on when the aircraft is
B on the ground, they get HOT. Before any maintenance
B work is carried out in the immediate vicinity of these
B vents it must be checked that the relevant heating
B supply is switched off, and a "DO NOT OPERATE" sign is
B placed on the relevant heater control switch. Ground
B operation of the vents heater should be kept to a
B minimum. Heaters should only be operated on the ground
B during Maintenance, when checking the function of the
B current sense relays, and correct operation of the
B heating circuits. Static vent heaters MUST NOT be
B switched on under any circumstances when protective
B covers, leak testing adaptors, or blanks are fitted.

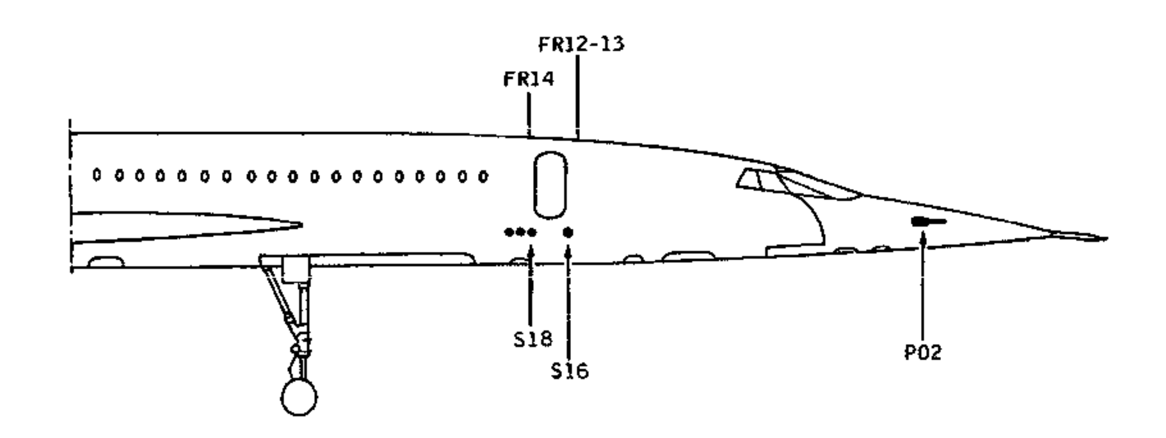
2. Static Ports

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	-
Access Platform, 14 ft 8 in (4.47 m)	-
Sealant (Ref. 20-30-00, No. 352)	-
Shrink Sleeve to Suit	-

B. Removal/Installation of Static Ports S16 and S18





CMA 34 11 35 4 AAM0

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Static Port Positions
Figure 401

(1) Prepare

(a) In zone 124, position access platform.

(b) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
ADS1 PROBE HTRS CONT IND	1-213	1H	1	K 8
ADS2 PROBE HTRS CONT IND	3-213	2H	1	A11
ADS1 STATIC VENT HTR SUP	13-215	1H	18	D 9
ADS2 STATIC VENT HTR SUP	13-216	2H	18	C12

(c) Remove galley (Ref. 25-24-31, Removal/Installation, 25-33-20, Removal/Installation).

(d) In passenger compartment, open floor panel 222BF for access to static port S16.

(e) In passenger compartment, open floor panel 222EF for access to static port S18.

(2) Remove (Ref. Fig. 402)

(a) In passenger compartment, gain access by floor panel 222BF for static port S16 and 222EF for static port S18. Remove insulation from fuselage internal lining in order to disengage appropriate static port.

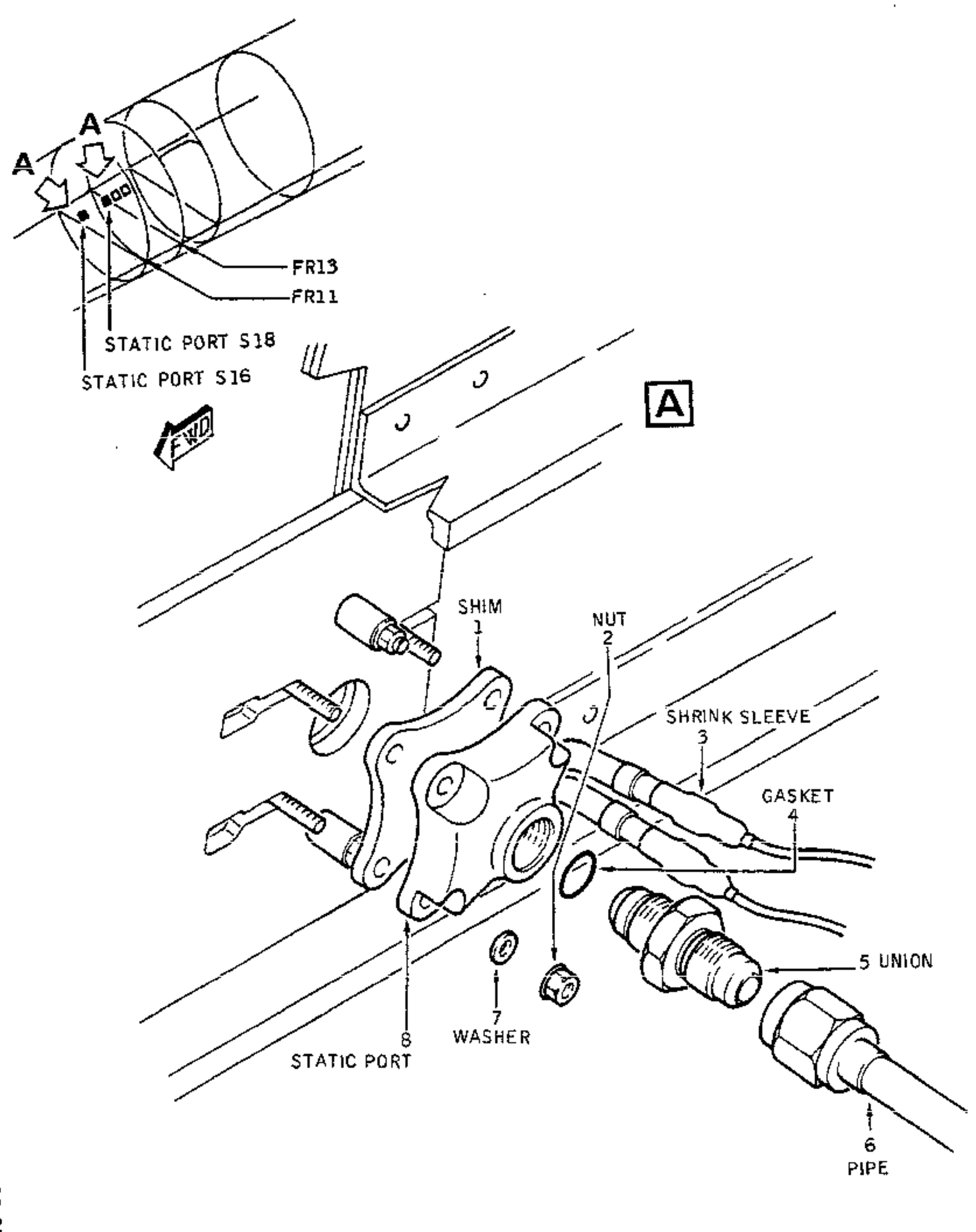
(b) Disconnect rigid air pressure pipe (6), from union (5).

(c) Remove union (5) from static port (8) and retain gasket (4).

(d) Remove shrink sleeve (3) protecting electrical connectors.

(e) Remove nuts from electrical connectors, retain screws and washers.

(f) Remove the four nuts (2), retain washers (7).



CMA 34 11 35 4 ACMO

Static Ports S16 and S18
Figure 402

R

(g) Pull gently to rear to remove static port (8), retain shim (1).

(h) Clean static port mounting area, and in particular remove all traces of seaing coumpound.

(3) Preparation of replacement component

(a) On new static port.

(a1) Remove blanking caps from air pressure connector and electrical connectors.

(a2) Make certain that component is not dented or deformed.

(a3) Check that ceramic insulators are not cracked, chipped or broken.

(b) On removed static port

(b1) Cap air pressure connector and electrical connectors.

(4) Install (Ref. Fig. 402)

(a) Place static port (8) in mounting position, inserting shim (1).

NOTE 1 : Sealing of assembly must be carried out using product No. 352 (Ref. 20-22-12).

NOTE 2 : Installed static port must be flush with fuselage, within tolerance limits of ± 0.0005 in. (0.012 mm). Correct flush shall be abtained be adjusting thickness of shim (1).

(b) Install the four washers (7) and the four nuts (2) ; torque nuts to between 25 and 30 lbf.in. (0.3 and 0.5 m.daN).

(c) Slide a shrink sleeve (3) on each electrical wire.

(d) Connect and attach electrical wires to each electrical connector of static port using washers and screws (respect electrical identifiers).

(e) Slide a shrink sleeve (3) on to each connector, heat until correct shrinkage is obtained.

(f) Install on new gasket (4) and install and tighten union (5) in static port (8).

(g) Connect rigid air pressure pipe (6) to union (5) and tighten.

(h) Return insulation to initial position.

CAUTION : MAKE CERTAIN THAT WORKING AREA IS CLEAN AND CLEAR OF TOOLS AND MISCELLANEOUS ITEMS OF EQUIPMENT.

(i) Close floor panel
222BF for static port S16
222EF for static port S18

(j) Install galley (Ref. 25-24-31, Removal/Installation, 25-33-20, Removal/Installation).

C. Removal/Installation of Static Port S17

(1) Prepare

(a) In zone 123, position access platform.

(b) Trip, safety and tag the following circuit breakers :

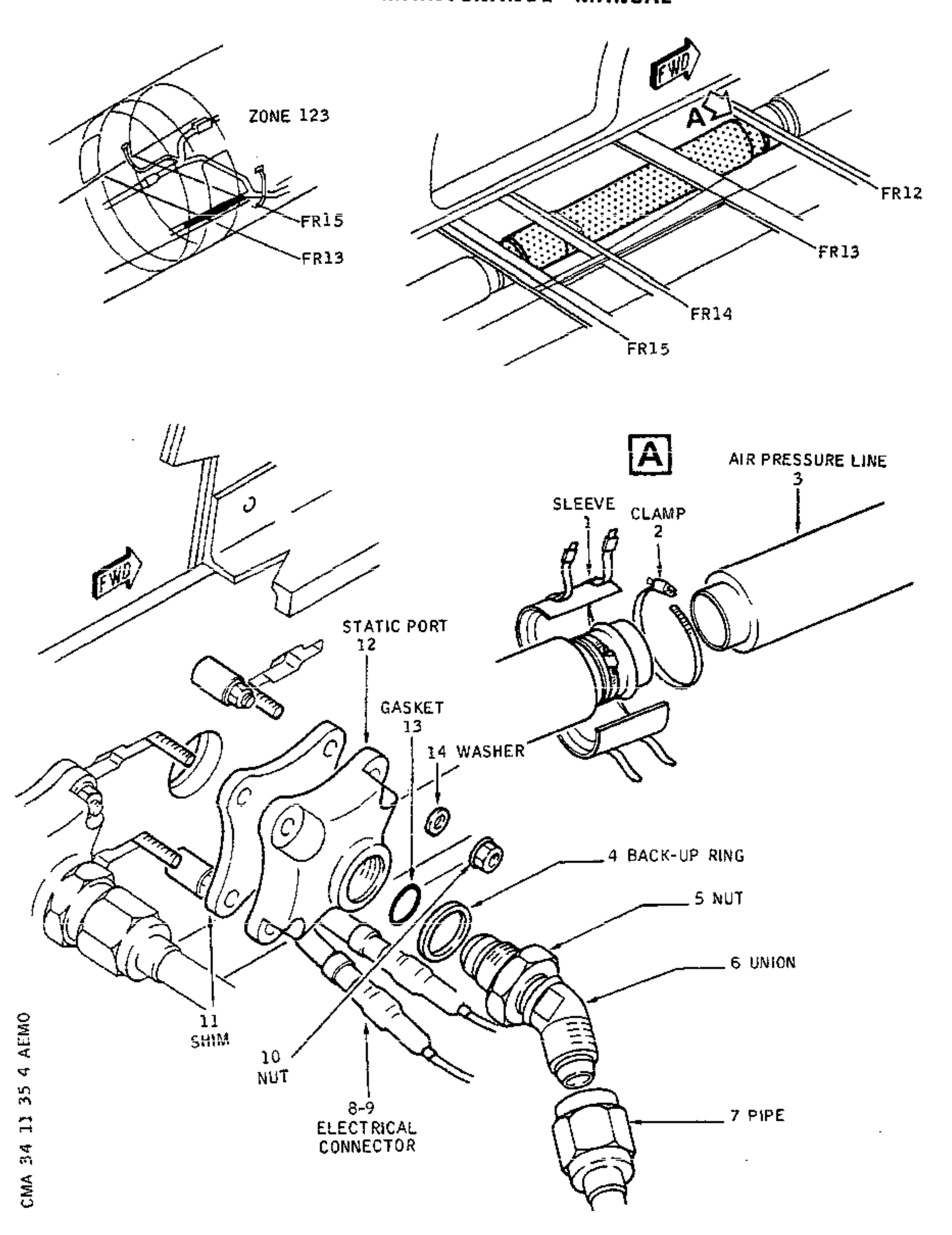
SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
ADS1 PROBE HTRS CONT IND	1-213	1H	1	K 8
ADS1 STATIC VENT HTR SUP	13-215	1H	18	D 9

(c) Remove galley (Ref. 25-24-31, Removal/Installation, 25-33-20, Removal/Installation).

(d) In passenger compartment, open floor panel 221BF.

(2) Remove (Ref. Fig. 403)

(a) NOTE : As the flexible air pressure lines are fragile, it is advisable to disconnect and remove them from the working area and to interpose a protective screen. Proceed as follows :



R

Static Port S17
Figure 403

(a1) In passenger compartment, gain access by means of floor panel 221BF, remove sleeve (1) from air pressure line (3) at frame 12.

(a2) Loosen and remove clamp (2).

(a3) Disconnect air pressure line (3), move to right.

(a4) If required, place a rigid protective screen between air pressure lines and working area.

(b) On fuselage internal lining, at static port position, unfasten insulation.

(c) Disconnect rigid air pressure pipe (7), from union (6).

(d) Remove nut (5) from union (6).

(e) Remove union (6) from static port (12) and retain back-up ring (4) and gasket (13).

(f) Remove shrink sleeve protecting electrical connectors (8) and (9).

(g) Loosen and remove nuts from electrical connectors, retain screws and washers.

(h) Loosen and remove the four nuts (10) and retain washers (14).

(i) Pull gently to rear to remove static port (12) and retain shim (11).

(j) Clean static port mounting area, and in particular remove all traces of sealing coumpound.

(3) Preparation of replacement component

(a) On new static port

(a1) Remove blanking caps from air pressure con= nector and electrical connectors.

(a2) Make certain that component is not dented or deformed.

(a3) Check that ceramic insulators are not cracked, chipped or broken.

(b) On removed static port.

(b1) Cap air pressure connector and electrical connectors.

(4) Install (Ref. Fig. 403)

(a) Place static port (12) in mounting position, inserting shim (11).

NOTE 1 : Sealing of assembly must be carried out using product No.352.

NOTE 2 : Installed static port must be flush with fuselage, within tolerance limits of ± 0.0005 in. (0.012 mm). Correct flush shall be obtained by adjusting thickness of shim (11).

(b) Install the four washers (14) and the four nuts (10); torque nuts to between 25 and 30 lbf.in. (0.3 and 0.5 m.daN).

(c) Slide a shrink sleeve (3) on each wire.

(d) Connect and attach electrical wires to each electrical connector of static port using washers and screws (respect electrical identifiers).

(e) Slide a shrink sleeve on to each connector (8) and (9), heat until correct shrinkage is obtained.

(f) Install back-up ring (4) and a new gasket (13) and install and tighten union (6) in static port (12).

(g) Install nut (5) on union (6) and tighten until nut presses against static port.

(h) Connect rigid air pressure pipe (7) to union (6) and tighten.

(i) Install insulation in its original position.

(j) Return flexible air pressure line (3) to initial position.
Procedure is as follows :

(j1) Remove protective screen, if applicable.

(j2) Connect air pressure line to air pressure system.

(j3) Install and tighten clamp (2).

(j4) Install and fasten sleeve (1).

CAUTION : MAKE CERTAIN THAT WORKING AREA IS CLEAN AND CLEAR OF TOOLS AND MISCELLANEOUS ITEMS OF EQUIPMENT.

(k) In passenger compartment, close floor panel 221BF.

(l) Install galley (Ref. 25-24-31, Removal/Installation, 25-33-20, Removal/Installation)

D. Removal/Installation of Static Port S19

(1) Prepare

(a) In zone 123, position access platform.

(b) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS2 PROBE HTRS CONT IND	3-213	2H 1	A11
ADS2 STATIC VENT HTR SUP	13-216	2H 18	C12

(c) Remove galley (Ref. 25-24-31, Removal/Installation, 25-33-20, Removal/Installation).

(d) In passenger compartment, open floor panels 221BF, 221EF and 221FF.

(2) Remove (Ref. Fig. 404)

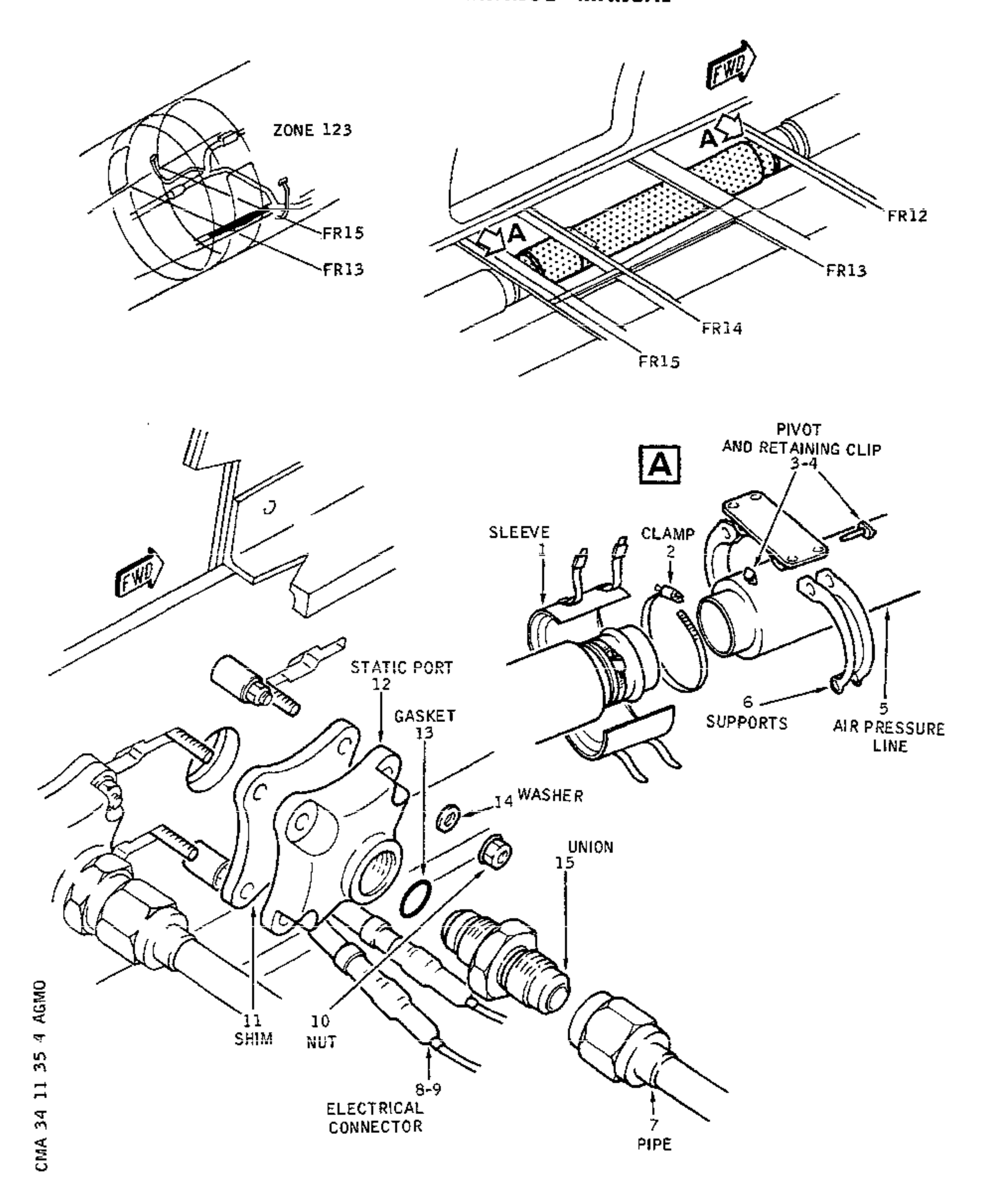
(a) In passenger compartment, remove air pressure line (5); gain access by floor panels 221BF, 221EF, 221FF as follows :

(a1) At frames 12 and 15, unfasten sleeve (1).

(a2) Loosen and remove clamp (2).

(a3) Remove pivots and retaining clips (3) and (4).

(a4) Remove supports (6).



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Static Port S19
Figure 404

(a5) Carefully disconnect and disengage air pressure line (5).

(b) On fuselage internal lining, at static port (12) position, unfasten insulation.

(c) Disconnect rigid air pressure pipe (7) from union (15).

(d) Remove union (15) from static port (12) and retain gasket (13).

(e) Remove shrink sleeve protecting electrical connectors (8) and (9).

(f) Loosen and remove nuts from electrical connectors, retain screws and washers.

(g) Loosen and remove the four nuts (10), retain washers (14).

(h) Pull gently to rear to remove static port (12), retain shim (11).

(i) Clean static port mounting area, and in particular remove any traces of sealing compound.

(3) Preparation of replacement component

(a) On new static port

(a1) Remove blanking caps from air pressure connector and electrical connectors.

(a2) Make certain that component is not dented or deformed.

(a3) Check that ceramic insulators are not cracked, chipped or broken.

(b) On removed static port

(b1) Cap air pressure connector and electrical connectors.

(4) Install (Ref. Fig. 404)

(a) Position static port (12) in mounting position, inserting shim (11).

NOTE 1 : Sealing of assembly must be carried out

using product No.352.

NOTE 2 : Installed static port must be flush with fuselage, within tolerance limits of 0.0005 in. (0.012 mm). Correct flush shall be obtained by adjusting thickness of shim (11).

(b) Install the four washers (14) and the four nuts (10).
Torque to between 25 and 30 lbf.in (0.3 and 0.5 m.daN).

(c) Slide a shrink sleeve on each wire.

(d) Connect and attach wires to each electrical connector of static port using washers and screws (respect electrical identifiers).

(e) Slide a shrink sleeve on to each connector (8) and (9), heat until correct shrinkage is obtained.

(f) Install a new gasket (13) and install and tighten union (15) in static port (12)

(g) Connect rigid air pressure pipe (7) to union (15) and tighten.

(h) Install insulation in its initial position.

(i) Install air pressure line (5).
Procedure is as follows :

(i1) Carefully position air pressure line in initial position, engaging line ends.

(i2) Position supports (6).

(i3) Install pivots (3) and retaining clips (4).

(i4) Install and tighten clamps (2).

(i5) Install and fasten sleeves (1).

WARNING : MAKE CERTAIN THAT WORKING AREA IS CLEAN AND CLEAR OF TOOLS AND MISCELLANEOUS ITEMS OF EQUIPMENT.

(j) In passenger compartment, close floor panels 221BF, 221EF and 221FF.

(k) Install galley (Ref. 25-24-31, Removal/Installation, 25-33-20, Removal/Installation).

D. Test

(1) Carry out a test of static ports replaced (Ref. 34-11-35, Adjustment/Test).

(2) Remove safety clips and tags and set the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS1 PROBE HTRS COND IND	1-213	1H 1	K 8
ADS2 PROBE HTRS COND IND	3-213	2H 1	A11
ADS1 STATIC VENT HTR SUP	13-215	1H 18	D 9
ADS2 STATIC VENT HTR SUP	13-216	2H 18	C12

(3) Carry out a test of air data system static ports heating (Ref. 30-31-00, Adjustment/Test).

STATIC PORTS - ADJUSTMENT/TEST

1. General

Check of static air pressure system after replacement or check of one or more air data system static ports (S16, S17, S18, S19)

2. Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Access Platform 14 ft. 8 in. (4.47 m)	
Access Platform 13 ft. (4 m)	
Pressure Generator	
Adapter - Static Ports	T8751E22783002
Adapter - Static Ports	T8751E22783003
Adapter - Pitot Tube	853BFT025
Blanking Plug - Pitot Tube Drain Port	853BFT026
Ground Service Telephone	

B. Prepare

(1) Aircraft must be in ground configuration, shock absorbers compressed.

(2) In flight compartment, on centre console, panel 9-211, make certain on ADC control panel that

(a) ADC1 and ADC2 ON-OFF switches are in OFF position.

(b) TEST selector switches are in NORM position.

(3) On overhead panel 4-211, make certain that ADS & ENG PROBE HEATERS switches are in OFF position.

(4) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH UC WEIGHT SW "A" SYS SUP	1-213	G 292	M17
ADC1 28V SUP		1F 74	P12
1ST PLT ADC INST SUP	2-213	1F 75	B 3
ADC1 26V SUP		1F 78	A 2
ADC1 115V SUP		1F 73	F 3
FLT CONT & NAV BUS 14X		X 355	H 2
RH UC WEIGHT SW "B" SYS SUP	3-213	G 294	B 9
FLT TEST 115VAC SUP	4-213	X 481	B22
ADC2 28V SUP	5-213	2F 74	F12
PLT'S LT TEST SUP	15-215	L1001	E14
2ND PLT ADC INST SUP	13-216	2F 75	A14
NAV INST BUS 13X		X 345	G 4
FLT TEST 26VAC SUP		X 480	B18
ADC2 26V SUP		2F 78	F14
ADC2 115V SUP		2F 73	F15

(5) Trip, safety and tag the following circuit breakers (depending on system concerned) :

(a) For ADC1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SENSOR UNIT 1 SUP	2-213	1K2052	A14

(b) For ADC2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SENSOR UNIT 3 SUP	2-213	3K2052	G14
SENSOR UNIT 4 SUP	14-216	4K2052	C 5

(6) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(7) Switch on electronics rack ventilation system (Ref. 21-21-00).

(8) On Captain instrument panel (2-211) and First Officer instrument panel (2-212)

(a) On altimeter

(a1) Using button in lower LH corner, set barometric pressure of 1013 mb (29.92 in.Hg), which can be read on the two barometric display counters.

(a2) Make certain that the letter N (normal) is visible at selection knob on lower RH corner of altimeter and that letters ADC are read on annunciator.

(b) On airspeed indicator

(b1) Make certain that letter N (normal) is visible at selector switch in lower RH corner of indicator and that letters ADC are read on annunciator.

(9) Position access platforms

(a) In zone 124 for static ports S16 and S18.

(b) In zone 123 for static ports S17 and S19.

(c) In zone 113 for pitot head P03.

(d) In zone 114 for pitot head P02.

(10) Connect the following equipment to static ports.

(a) Static port S16 or S17 : adapter T8751E22783003.

(b) Static port S18 or S19 : adapter T8751E22783002.

(11) Depending on static port tested

(a) On appropriate adapter, remove blanking plug and connect adapter to pressure generator output PS with a hose.

(b) Make certain that blanking plug(s) are installed on apposite adapter(s).

NOTE : Static ports S16 and S19 supply the same plenum chamber, as do static ports S17 and S18. Thus when static port S16 is tested, static port S19 must be sealed with a blanking plug, and vice-versa. Similarly, if static port S17 is tested, static port S18 must be sealed, and vice-versa.

(12) In zone 113 on pitot head P03 (ADC1 system), or in zone 114 on pitot head P02 (ADC2 system), install

(a) Pitot tube adapter 853BFT025.

(b) Drain port blanking plug 853BFT026

(13) Using a hose, connect adapter 853BFT025 to pressure generator output PT.

(14) Switch on interphone and establish a connection between flight compartment and interphone box (Ref. 23-41-00, Adjustment/Test).

(15) Energize ADC1 or ADC2, depending on system being tested. To do this

(a) In flight compartment, on centre console panel 9-211, place ADC1 (ADC2) ON-OFF switch in ON position.

(b) After approximately 30 seconds, press then release amber ADC1 (ADC2) caption light
- caption light of relevant system must remain off.

(c) On Captain or First Officer instrument panel check that failure warning flags are not visible on
- airspeed indicator,
- altimeter,
- angle of attack indicator.

(16) On pressure generator set static pressure (PS) of 1013.2 mb. and delta P pressure of 0 mb.

(17) Start up pressure generator.

C. Leakage Test

NOTE : Depending on performance of pressure generator carry out leakage test following one or the other of the procedures described below.

(1) For a pressure generator capable of simulating an altitude of the order of 61,000 ft.

NOTE : For altitude corrections to be made when using pressure generator Ref. 34-11-00, Servicing.

(a) On pressure generator set PS of 70 mb. and delta P of 425 mb.

(b) Set vane of angle of attack sensor 1F91 (zone 113) or 2F91 (zone 114) to obtain an angle of attack of attack of 2° as read on angle of attack indicator 1F83 (panel 2-211) or 2F83 (panel 2-212) and hold sensor vane in this position.

(c) Check on altimeter 1F79 (panel 2-211) or 2F79 (panel 2-212) that altitude is 60,800ft.

(c1) On pressure generator, isolate static pressure (PS) system and check after 5 minutes that altitude discrepancy does not exceed 500ft.

(d) On pressure generator set PS of 151 mb and delta P of 600 mb.

(d1) Check on airspeed indicator 1F81 (panel 2-211) or 2F81 (panel 2-212) that airspeed is approximately 543.3 kt.

(d2) Isolate total pressure (PT) system and check after 10 minutes that airspeed discrepancy does not exceed 2 kt.

(e) On pressure generator, slowly return pressure controls (PS and delta P) to normal pressure values, then shut down pressure generator.

(2) For a pressure generator capable of simulating an altitude of the order of 30,000 ft.

(a) On pressure generator set PS of 300 mb. and delta P of 425 mb.

(b) Set vane of angle of attack sensor 1F91 (zone113) or 2F91 (zone 114) to obtain an angle of attack of 2° as read on angle of attack indicator 1F83

(panel 2-211) or 2F83 (panel 2-212) and hold sensor vane in this position.

(c) On panel 2-211 or 2-212, check

(c1) on altimeter that altitude is 29,700ft.

(c2) on airspeed indicator that airspeed is 476Kt.

(d) On pressure generator, isolate pressure system PS and delta P.

(d1) After 10 minutes, check
- on altimeter that altitude deviation does not exceed 400ft.
- on airspeed indicator that airspeed deviation does not exceed 2 kt.

(e) On pressure generator, slowly return pressure controls (PS and delta P) to normal pressure values, then shut down pressure generator.

D. Close-Up

NOTE : This close-up is common to all air data system static ports.

(1) On centre console panel 9-211 place ADC1 or ADC2 ON-OFF switch in OFF position.

(2) Remove equipment used for interphone connection.

(3) Switch off electronics rack ventilation system (Ref. 21-21-00)

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(5) Remove safety clips and tags and reset the circuit breakers tripped in paragraph 2. B. (5) (a) or 2. B. (5) (b).

(6) Disconnect hoses from outputs PS and delta P of pressure generator.

(7) In zone 113 for pitot head P03 or zone 114 for pitot head P02

(a) Remove blanking plug 853BFT026.

(b) Disconnect hose from pitot tube adapter.

(c) Remove pitot tube adapter 853BFT025.

(d) Install fuselage pitot head cover 2-753A060, if applicable.

(8) In zones 123 and 124, static parts S16, S17, S18, S19

(a) Disconnect hose from adapter of static port tested

(b) Remove adapters T8751E22783002 and T8751E22783003.

(c) Install static ports cover/blanks set E930004600, E93004700 or E93004800, if applicable.

(9) In zones 113 and 114, install pitch incidence vane covers D935181000, if applicable.

(10) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(11) Remove access platforms

(a) In zones 113 and 114.

(b) In zones 123 and 124.

(12) Stow pressure generator hoses.

END OF THIS SECTION

NEXT

AIR DATA COMPUTER - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

The air data computer is used for measurement and distribution of air data parameters. It converts input parameters into parameters required for flight control. Two computers (1F71 and 2F71) are installed on shelves 6-215 and 6-216 respectively.

2. Description

A. Mechanical Characteristics

The air data computer is housed in a rectangular case. On the front panel are :

(1) STATIC and PITOT connectors to which are sent information from the static pressure (Ps) and total pressure (Pt) sensors.
Other input information (Ii, θn, Ti and W) are introduced electrically by six connectors at the rear.

(2) A pluggable test panel on which are mounted :

- 4 internal test command push-buttons
- 6 test indicator lights
- indicator light test push-button

(3) A test connector for workshop checks

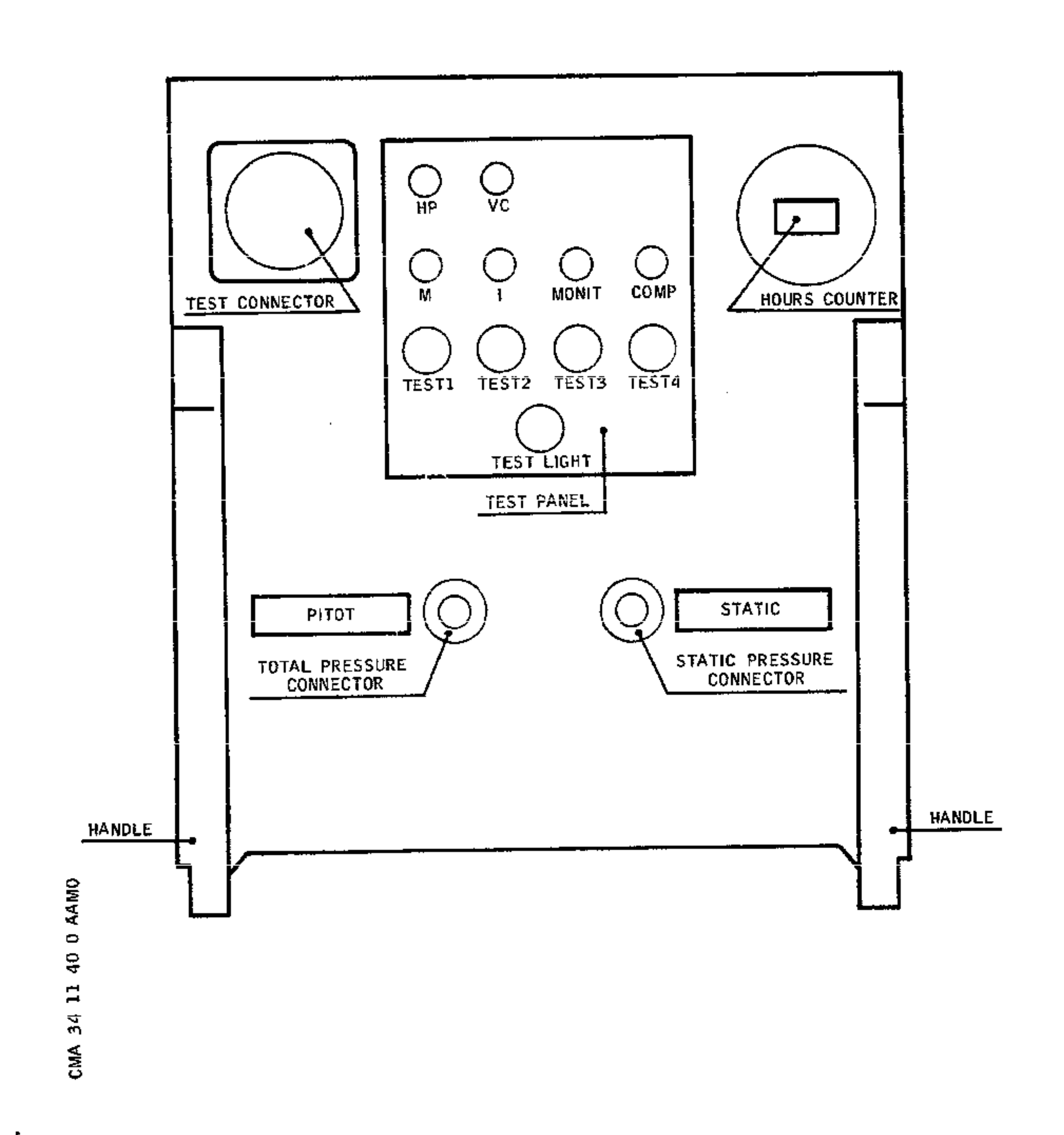
(4) An hours counter

(5) Two locking handles for handling and locking

B. Information Characteristics

(1) Input information

INPUTS	UTILIZATION
Local static pressure (Psi)	55 mb to 1050 mb
Local total pressure (Pti)	0 mb to 1800 mb
Dynamic pressure (PT-Ps)	0 mb to 750 mb
Impact temperature (Ti)	-50°C to +200°C
Local angle of attack (Ii)	0° to ± 35°
Nose position (θ n)	0° to 12.5°
Total aircraft weight (W)	75 to 200 tonnes



Air Data Computer : Front View
Figure 001

(2) Output information

	OUTPUTS	RANGES
	Altitude (Hp)	-1000 to 65000 ft
R	Altitude hold (Δ Hp)	± 4000 ft
	Mach number (m)	0.25 to 2.4 m
	Mach hold (Δ m)	± 0.15 m
	Calibrated air speed (Vc)	50 to 600 kts
	Speed hold (Δ Vc)	± 60 kts
	Vertical speed (Vz)	0 to ± 30000 ft/min
	Static temperature (Ts)	-100°C to + 50°C
	True airspeed (Vt)	150 to 1300 kts
	Angle of attack (Iv)	- 10° to + 25°
	Total temperature (Tt)	- 50° to + 200°C
	Overspeed warning	Warning if : Tt is greater than 404°K (131°C) Vc is greater than VMO1 + 6 kts Vc is greater than 270kts with nose in droop position M is greater than 0.95 with visor lowered
	Maximum allowable airspeed (VMO)	300 - 530 kts
R		
R	Maximum allowable mach (MMO)	0.45 to 2.04 M
	Minimum authorised airspeed (VLA)	0 - 400 kts

3. Operation

A. Definition and Checks

(1) Air data parameters (Ref. Fig. 002)

R (a) Altitude (HP) is a function of Ps = Psi - dPs.

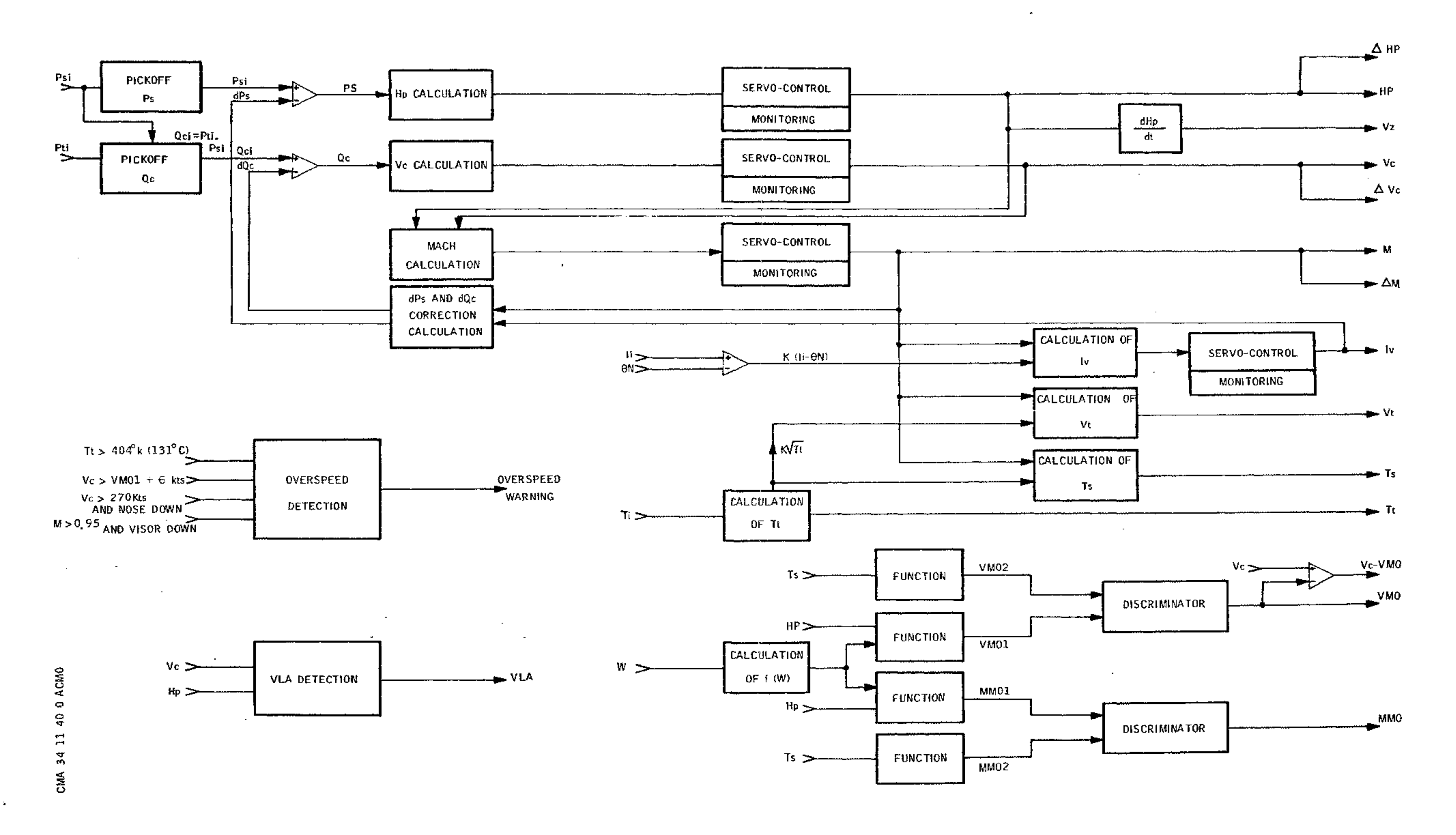
(b) Calibrated airspeed (Vc) is a function of
R Qc= Qci - dQc

(c) Mach number is a function of calibrated airspeed and altitude.

(d) Error correction dPs is a function of static
R pressure, mach and angle of attack.

R (e) Error correction factor dQc is a function of cor-
R rection factor dPs, mach and differential pressure

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Air Data Parameter Calculation - Block Diagram
Figure 002

(Qc).

(f) Angle of attack is a function of local angle of attack, droop nose position angle and mach number.

R (g) Vertical speed (Vz) is the time derivative of al-
R titude.

(h) True airspeed (Vt) is a function of impact temperature and mach number.

(i) Static temperature (Ts) is a function of impact temperature and mach number.

(j) Total temperature (Tt) is a function of impact temperature.

(k) Minimum authorised airspeed (VLA) is a function of calibrated airspeed and altitude.

(l) Maximum allowable airspeed and mach number.
The structural limit which is a function of altitude and total aircraft weight, is expressed :

- in speed by VMO1= f1 (Hp) and f2 (W).
- in mach number by MMO1= f3 (Hp) and f4 (W).

The heating limit, which is a function of static temperature is expressed :

- in speed by VMO2= g1 (Ts)
- in mach number by MMO2= g2 (Ts)

Only the lowest of these two limits is sent to the check instruments.

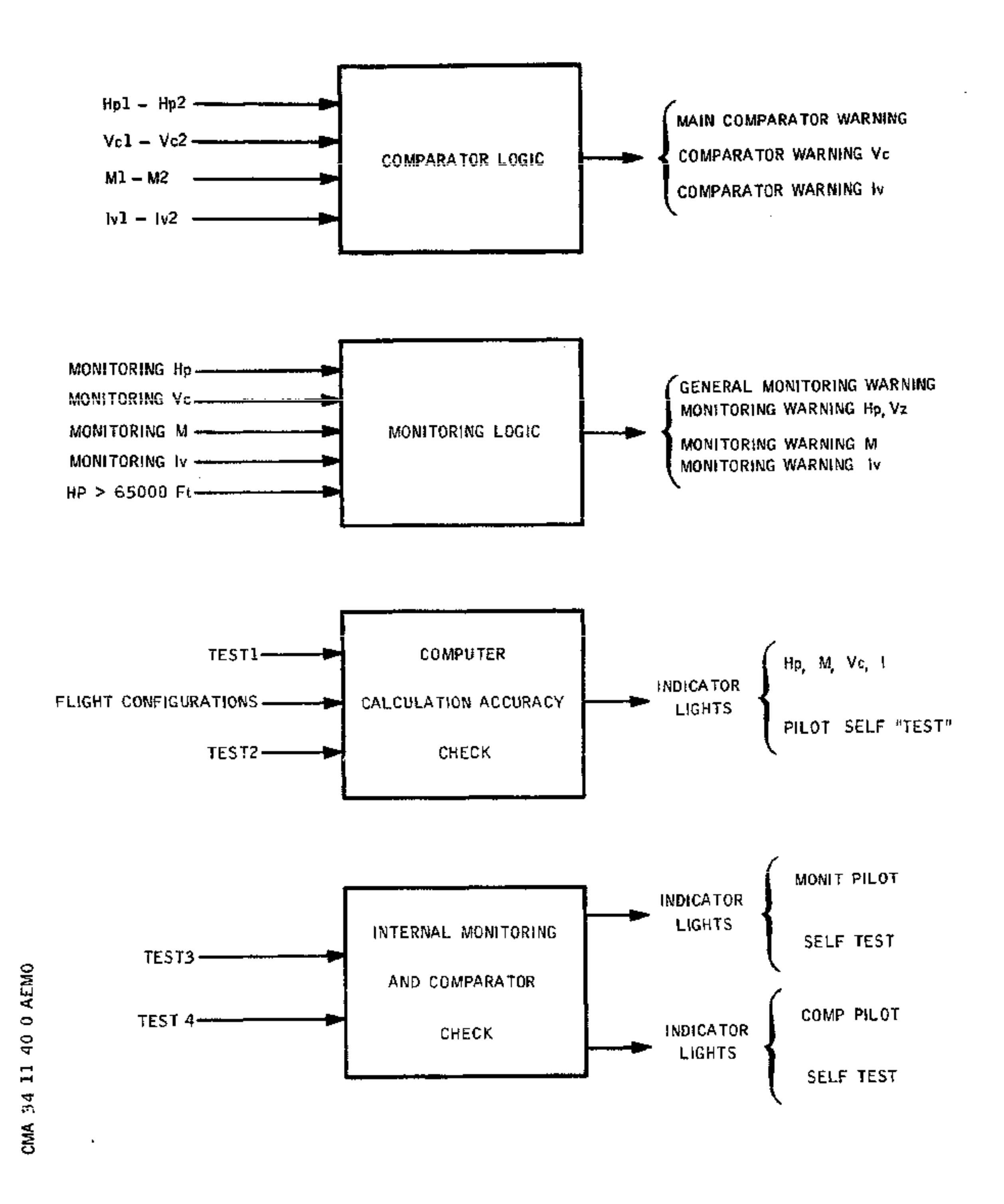
(m) Overspeed warning

The warning is activated when one of the following four conditions arises :

- Calibrated airspeed exceeds by 6 kts structural limit VMO1.
- Total temperature exceeds 404°K (131°C).
- Calibrated airspeed exceeds 270 kts with nose in down position
- Mach number exceeds 0.95 with visor lowered.

(2) Check of operation (Ref. Fig. 003)

Check of computer operation is made by three indepen-



Warnings and Tests - Block Diagram
Figure 003

dent methods :

- internal monitors
- comparisons
- self-tests.

(a) Internal monitors

The internal monitor system continuously checks error signal level of each servo-system. When the error signal level exceeds a certain threshold for more than two seconds, a warning is activated and held, the warning can only be cancelled by the Pilot.

(b) Comparisons

Comparison is made between altitude, mach number angle of attack and calibrated airspeed parameters coming from the two computers.

(c) Self tests

Self tests enable verification of correct computer operation before flight. Control can be made from the front panel or remotely.

(d) Self tests 1 and 2

These two tests check computer calculation accuracy in two flight configurations. Visual checks are made by means of four indicator lights Hp, Hi, Vc and I on the front panel of the computer or by indicators at the Pilot position.

(e) Self tests 3 and 4

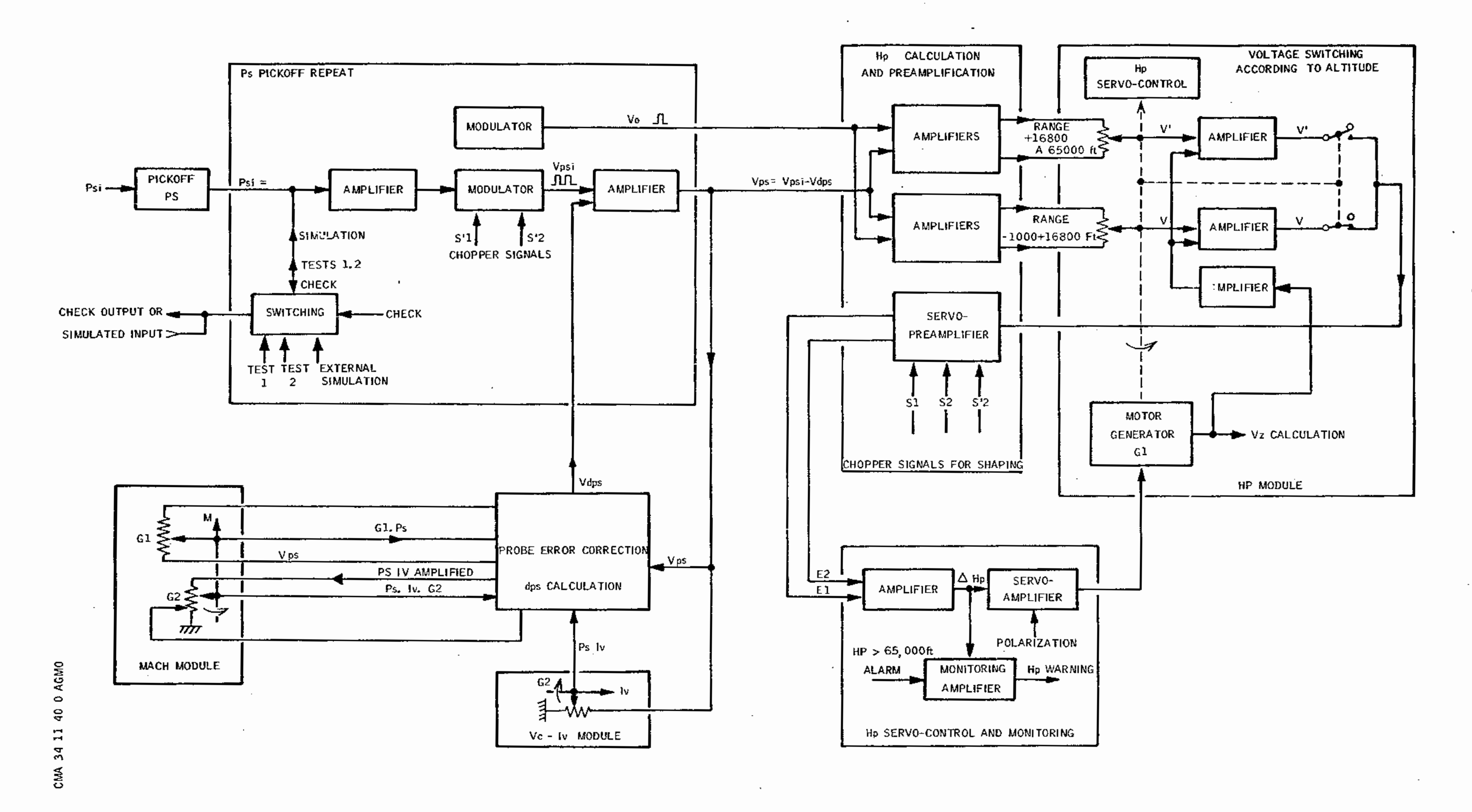
These tests enable a check of correct operation of internal monitors and comparators. Checks are made by means of indicator lights on the computer front panel, or by indicators at the Pilot positions.

B. Parameter calculations

(1) Hp calculation channel (Ref. Fig. 004)

Altitude (Hp) is a function of true static pressure : Ps= Psi - dps (dps being the sensor error correction). Pick off Ps receives Psi information from the static port which it converts into a DC voltage Vpsi. The vol-

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Hp Calculation Channel - Block Diagram
Figure 004

tage is amplified, modulated by square wave signals and summed with an error voltage from the sensor (Vdps) in a differential amplifier to give :
Vps= Vpsi - Vdps. The pick off repeater circuit enables by means of a switching device :

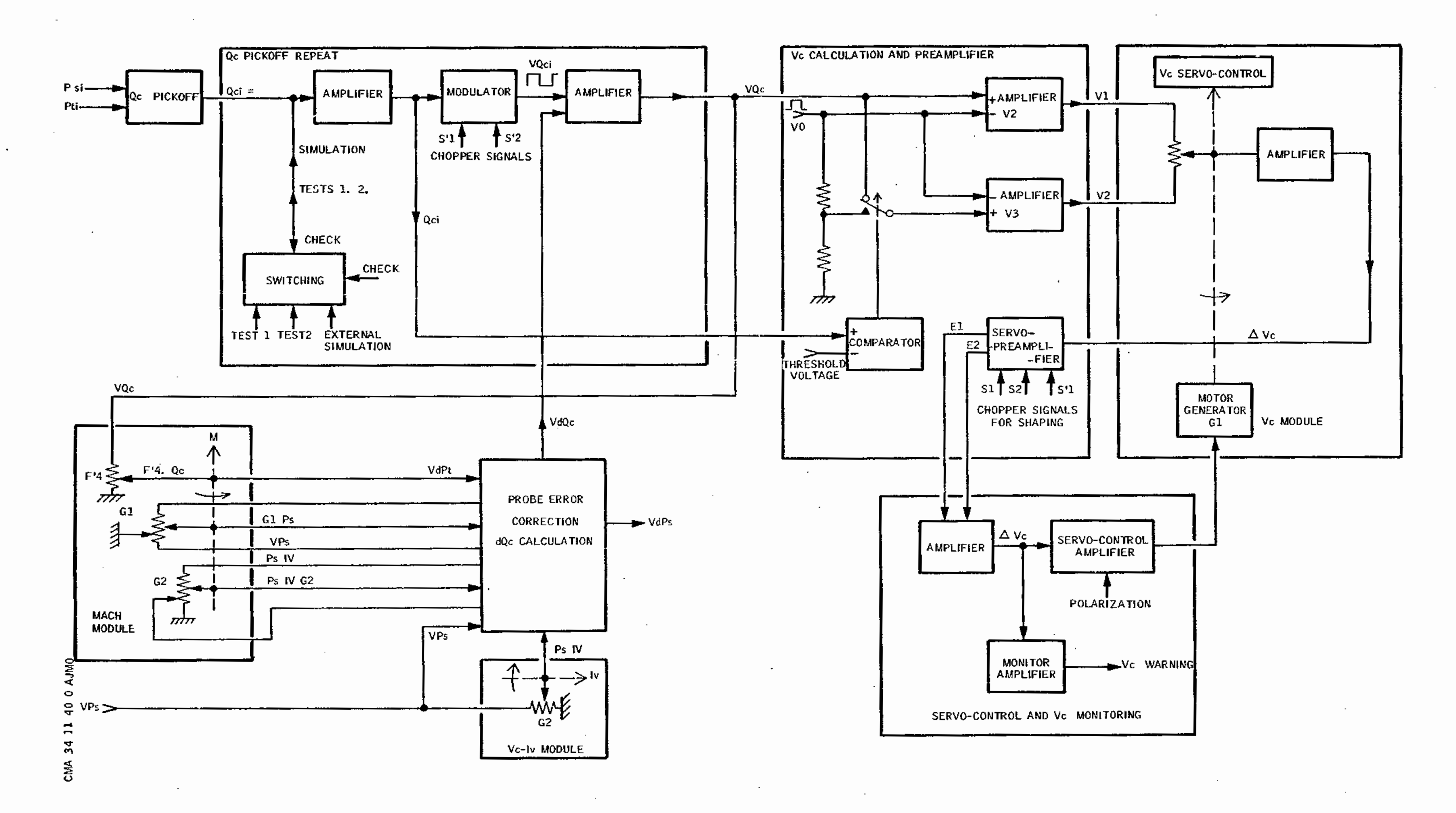
- pick off simulation for self tests. Self tests 1 and 2 simulate on the ground two flight conditions Hp= 10000 ft, Hp= 48000 ft.
- external simulation of pick off Ps for computer workshop check.
- check of the pick off by measurement of voltage Psi from the pick off without removal of computer.

A check output and simulated input is available at the switching stage.
The sensor error correction circuit outputs voltage Vdps for calculation of true Ps. Sensor error correction is a function of true static pressure and mach and angle of attack channels which control function potentiometers. Potentiometers G1 and G2 on the mach module transmit G1. Ps and Ps.Iv.G2 to the correction system to be summed in order to obtain voltage Vdps. Ps.Iv information produced by potentiometer G2 on Vc-Iv module is amplified in the error correction system. The Hp calculation circuit and preamplifier receives voltages Vdps and Vo from a modulator stage. Two amplifier chains are connected to two potentiometers controlled by Hp module, each potentiometer operates in one of the following ranges :

- 1000 to 16800 ft and + 16800 to 65000 ft. Error voltages V and V' obtained from these potentiometers are amplified and successively switched through a two way switch, servo controlled by Hp channel. The selected voltage is sent to a servo preamplifier which converts the voltage by chopper action.
  The servo control and monitor circuit Hp receives voltages E1 and E2 from the preamplifier, the voltages are summed in an amplifier whose output is ΔHp= K (E2-E1), the servo control signal. This signal is applied to a polarized servo amplifier which controls the Hp module motor generator and to a monitor amplifier to supply an Hp warning when the signal level exceeds a given threshold. The motor generator forms
R part of the mechanical Hp servo channel and drives the rotary devices and supplies a signal for calcu-
R lation of vertical speed Vz. The servo-channel is
R driven to low values in case of failure.

(2) Vc calculation channel (Ref. Fig. 005)

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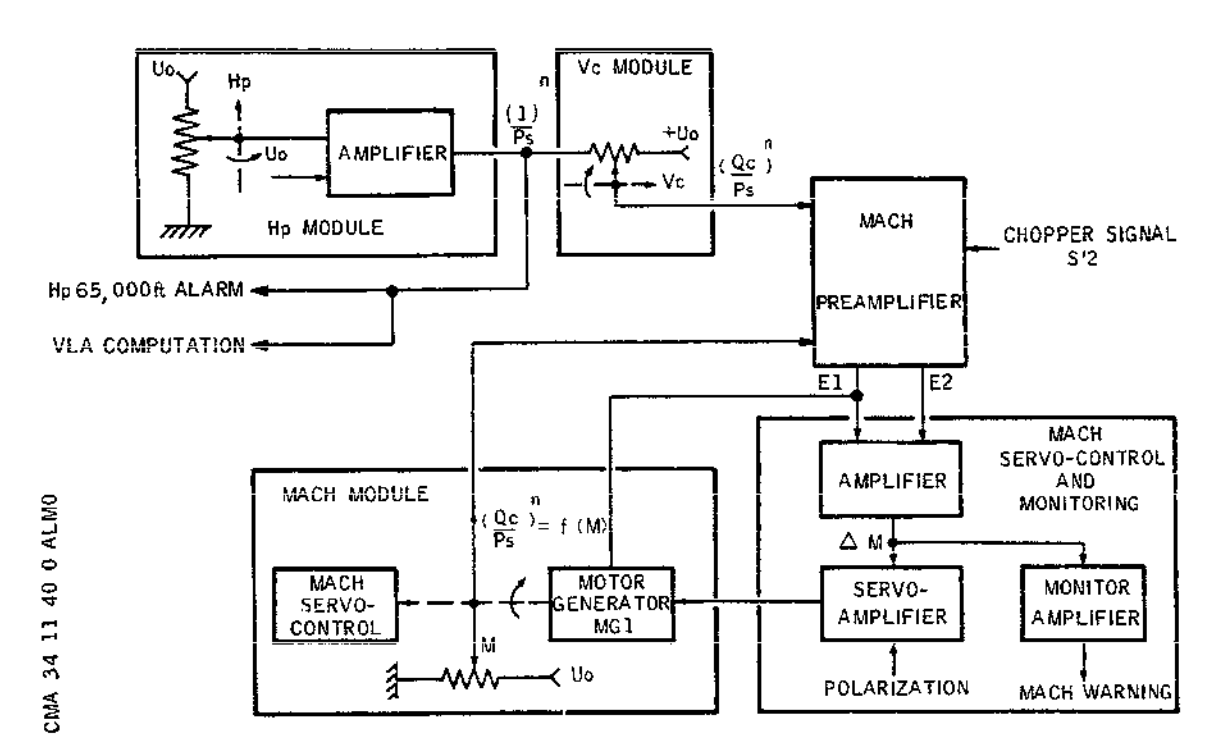
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Vc Calculation Channel - Block Diagram
Figure 005

Calibrated airspeed Vc is a function of differential pressure Qc such that Qc= Qci - dQc. Qci is given by pick off Qc and dQc calculated as a function of mach number, error correction dps and differential pressure Qc.
Pick off Qc receives pressures Psi and Pti supplied by the total pressure probes, and static pressure. It enables measurement of local differential pressure Qci= Pti-Psi which it transmits in DC voltage form to the pick off repeat circuit. This circuit is identical with that described in the Hp calculation channel. The probe error correction circuit produces voltage VdQc. Calculation of dQc is made from dPt and dPs. dPs is calculated in the Hp channel, obtained by summation of G1. Ps and Ps.Iv.G2 information.
dPt signal is generated by a function potentiometer supplied by voltage VQc and driven by the mach channel. Vc calculation circuit and preamplifier consists of two amplifiers which receive voltage VQc and a reference voltage Vo.
These two amplifiers supply a function potentiometer servo controlled by Vc channel. The servo-control signal is taken from the potentiometer slider and amplified, it is then sent to the servo preamplifier. Calibrated airspeed Vc is calculated between 50 and 600kts. When this speed is less than 50 kts, voltage Qci applied to the positive input of comparator is less than the negative input threshold voltage. This condition causes the comparator output to switch the positive input of amplifier V3 to a fixed voltage level corresponding to Qc for Vc = 50 kts. The servo channel therefore remains set at 50 kts for any values of Qc between 0 and 4 mb. This locking of calculation is effected because of the small variations of error signal voltage from the function potentiometer in the 0 to 50 kts range.
The preamplifier, servo amplifier and monitor amplifier system is identical with that of the Hp channel.
The mechanical servo channel Vc consists of the motor-
R generator MG1 which drives the rotary devices. It is
R driven to low values in case of failure.

(3) Mach calculation channel (Ref. Fig. 006)

Mach number is a function of static pressure and differential pressure according to the general expression M = f (Qc/Ps).
Altitude channel Hp drives the Hp module function potentiometer which supplies signal (1/Ps) to power n which is a function of altitude.
The voltage on the potentiometer slider supplies,



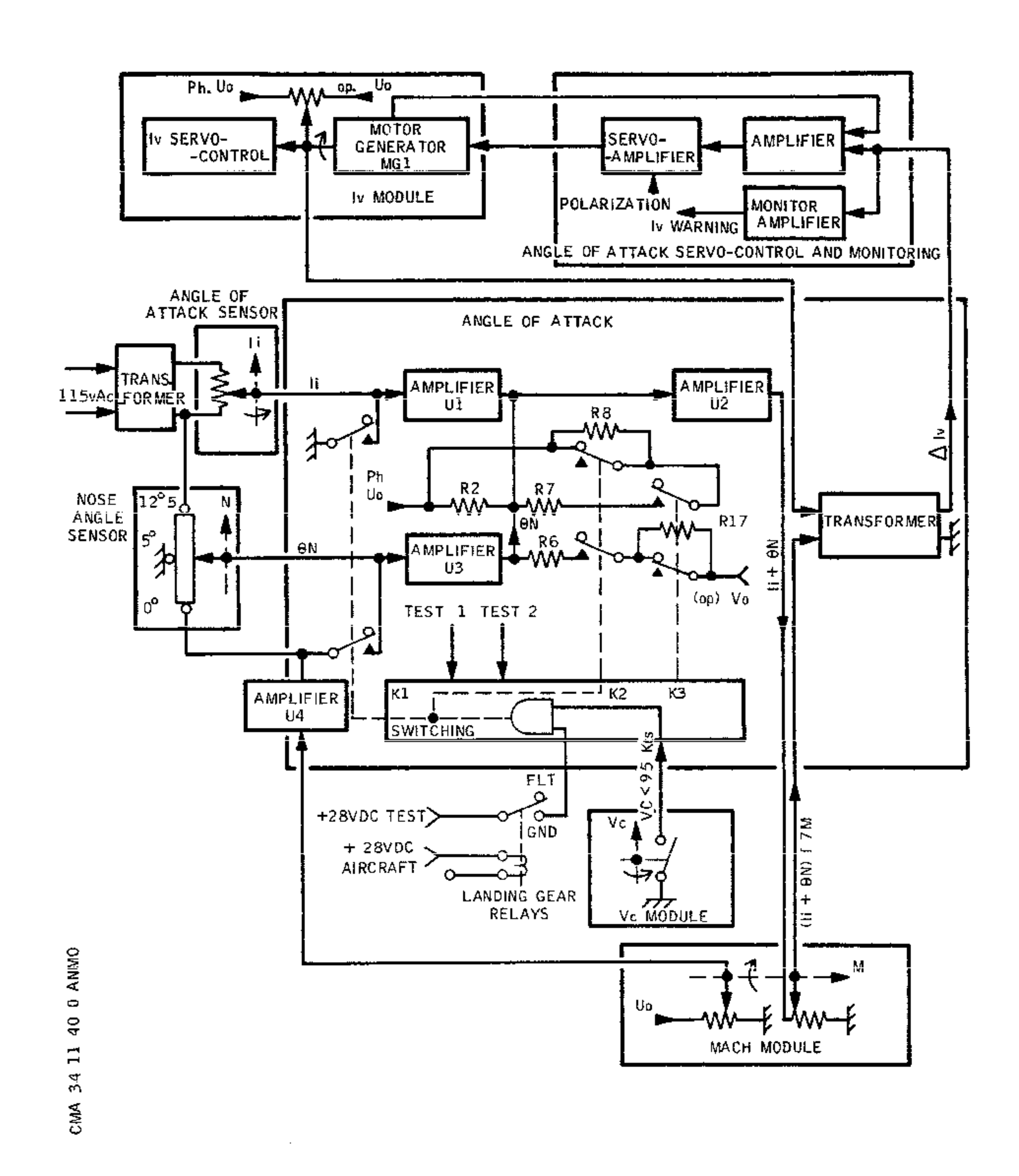
Mach Calculation Channel : Block Diagram
Figure 006

through a repeat amplifier, a function potentiometer on Vc module. This potentiometer servo controlled by the calibrated airspeed channel Vc, multiplies the received signal 1/Ps by Qc to power n speed function. Information (Qc/Ps) to power n = f(m). The difference of the two signals is modulated in the preamplifier by means of a chopper signal. At the output the signals E1 and E2 are summed in an amplifier whose output is the Δm servo control signal.
The servo-control and monitor amplifier operation is identical with that of the Hp calculation channel.
The servo-amplifier output signal controls the motor generator MG1 which drives the rotary devices.

(4) Angle of Attack calculation channel (Ref. Fig. 007)

(a) Calculation

Angle of attack (IV) is a function of local angle of attack (Ii) and nose position angle (θn) and mach number.
Signal (Ii) is supplied by a potentiometer driven



Angle of Attack Calculation Channel :
Operation Block Diagram
Figure 007

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by the angle of attack sensor vane on the aircraft nose. This signal is sent through an impedance matching amplifier to the input of amplifier V2. θn information depends on the nose position, (0°, 5°, 12.5°). For a value N = 0°, θn is a function of mach number. The nose angle sensor potentiometer supplies θn from three supplies according to nose droop angle. For N = 12.5° and 5° the supply is a fixed voltage level and for N - 0°, a voltage which is a function of mach number. In the special case of N = 0°, the voltage expressed as θn = f(M) is produced by a function potentiometer in the mach module, servo-controlled by the mach channel. This voltage is applied to amplifier U4, then repeated by impedance matching amplifier U3. Ii and θn information is summed and repeated by amplifier U2. The resultant signal (I + θN) supplies a function potentiometer in the mach module servo-controlled by the mach channel. Function f7(m) of the potentiometer represents the correction between local and true values of mach. The slider voltage is proportional to true angle of attack
R IV = (Ii + θn) f7 m and is sent to a transformer with the repeat voltage supplied by the linear potentiometer driven by the motor generator. At the transformer output, voltage ΔIV enables control of the servo-amplifier. The servo and monitor amplifiers operate in a similar manner to the Hp calculation channel amplifiers.
The motor generator operates on IV and drives the rotary devices.

(b) Switching

Angle of attack simulation during self tests is made by means of tests 1 and 2 operated from the computer front panel.
These tests simulate on the ground two flight parameters : test 1, IV = 21°5, test 2, IV = 3.4°.
During test 1, relays K1 and K3 are energized and cause :

- grounding of Ii information and input of a signal θn to amplifier U2, corresponding to test 1 mach number.
- application to amplifier U2 of a simulation voltage derived from voltage Vo, and resistors R2 and R7.
  During test 2, relays K1, K2 and K3 are energized enabling :
- Ii = 0° and θN = f(m).

- application to amplifier V2 of a simulation voltage derived from Vo and resistors R2, R7 and R8.

(c) Locking of angle of attack calculation when Vc is less than 95kts.

For all values of Vc less than 95kts, the system holds IV servo-control in a position such that IV = 1°. For Vc less than 96 kts, a contact controlled by the Vc channel closes, and places a ground on the switching stage enabling energization of relays K1 and K2 which causes :
- Ii = 0° and θN = f(m)
- application of a voltage (ii + θN) corresponding to IV = 1° obtained from a voltage Vo and resistor R6.

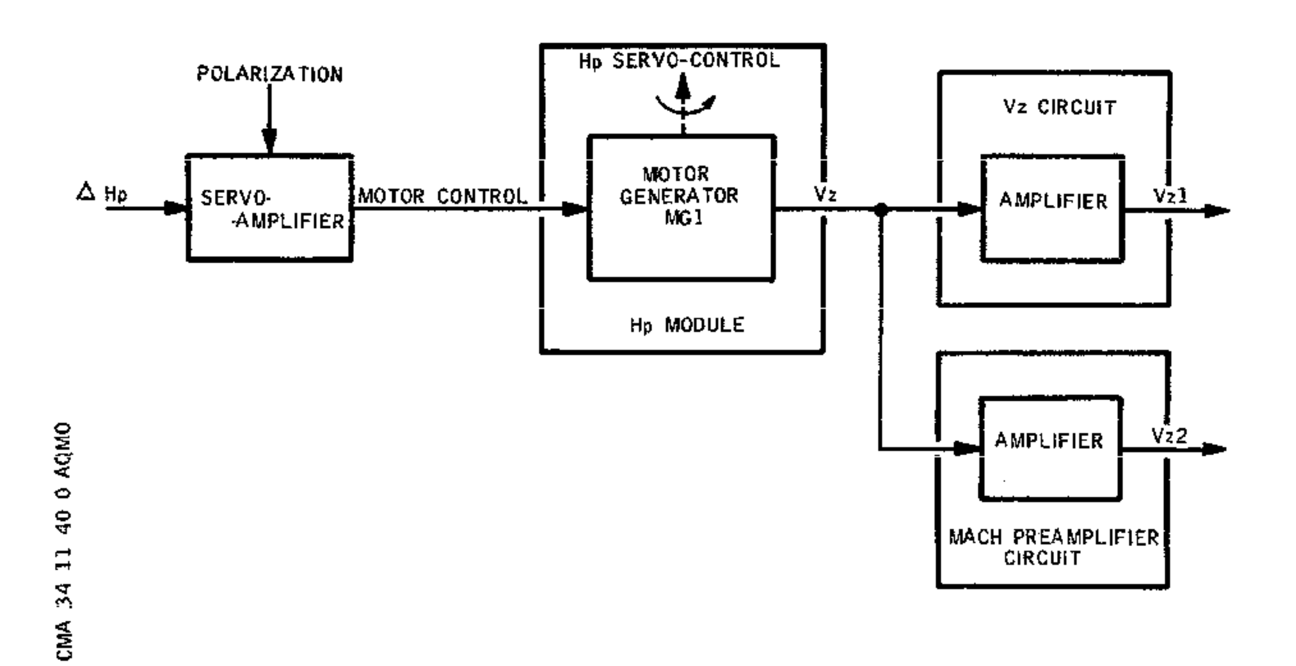
R Switching can be inhibited on the ground by de-
R energization of landing gear weight relays G310
R for ADC1, G300 for ADC2 (Ref. 34-11-00,
R Description and Operation, paragraph 4.E.(1)(a)).

(5) Vertical speed calculation channel (Ref. Fig. 008)

Vertical speed is derived from altitude with respect to time. It is obtained from the Hp altitude module motor generator. The motor rotation is according to Hp altitude and drives a tacho-generator, whose rate of rotation is proportional to vertical speed Vz, the generator output voltage is proportional to Vz (Vz = dHp/dt).
Voltage Vz is sent to two separator amplifiers in the Vz and mach preamplifier circuits, whose outputs are AC signals Vz1 and Vz2. The amplifiers operate in the range 0 to ± 30000 ft/min.

(6) Static and total temperature calculation channel (Ref. Fig. 009)

(a) Principle of total temperature calculation (Tt).
Total temperature is calculated from T1 information provided by the total temperature sensor, of which the resistance varies with temperature.
Ti signal is expressed as Ti = Ki, Tt, K being a function of mach number.
The sensor input circuit consisting of resistors R1, R2, and R3 supplies a voltage Vs = f.Tt which can be expressed as K' square root Tt, in the temperature range -50°C (223°K) to + 200°C (473°K).



Vertical Speed Calculation Channel
Block Diagram
Figure 008

(b) Line resistance compensation

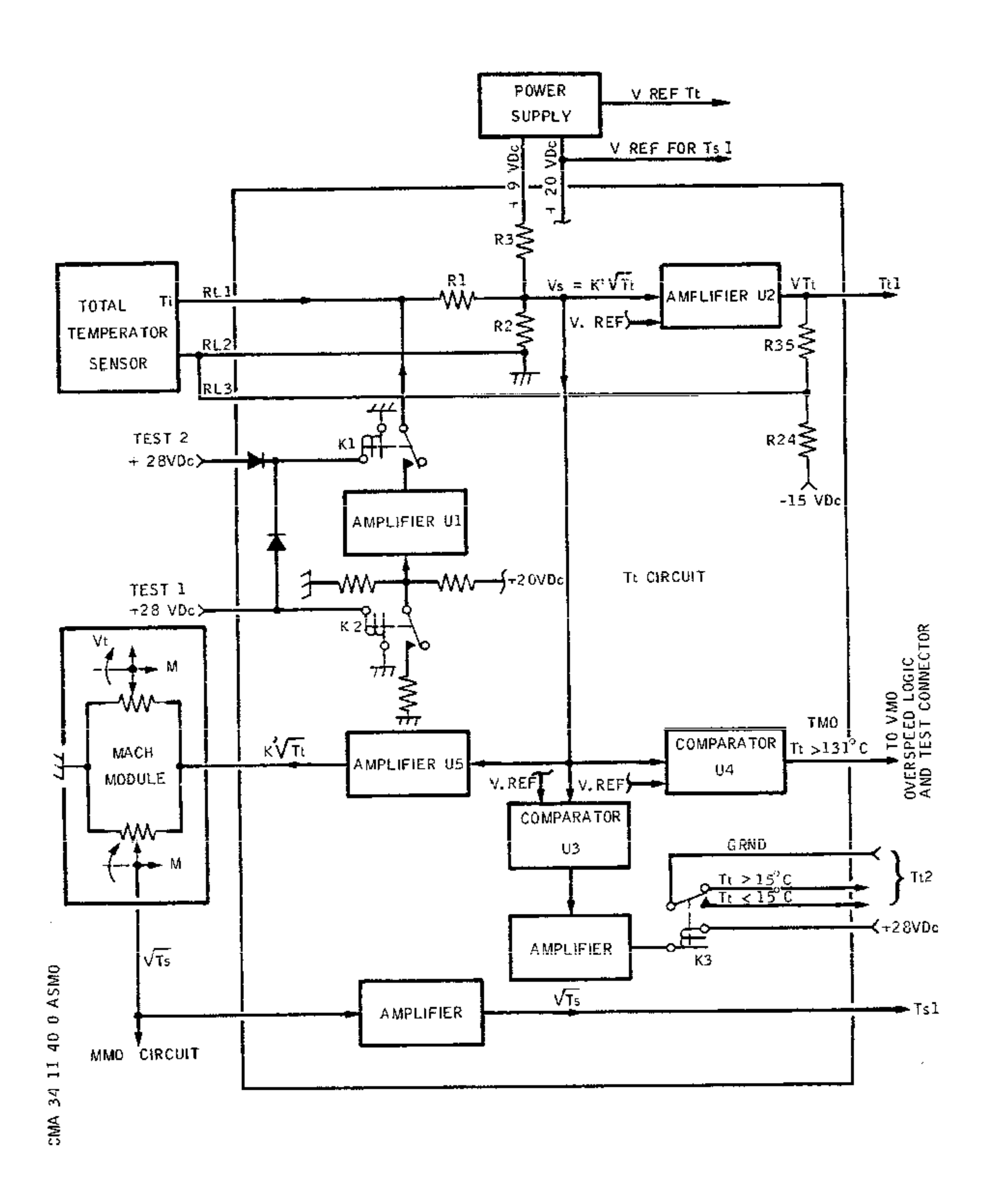
Compensation of line resistance is obtained by means of a three wire line RL1, RL2, RL3. The current circulating in RL1 and RL2 produces a line voltage drop. To eliminate this loss, a voltage drop of opposite sign is produced by an opposing current in RL3 and RL2 by means of resistors R24 and R35 according to the following conditions :

- when Tt = -50°C (223°K) the current is determined by R24, as at this temperature voltage VTt is nil.
- when the temperature rises the voltage drop is compensated through R35 supplied by VTt.

(c) Total temperature outputs

(c1) Tt1 output

Tt1 output supplies a DC voltage from voltage



Total and Static Temperature Calculation
Block Diagram
Figure 009

Vs repeated by impedance matching amplifier U2.

(c2) Tt2 output

Output Tt2 consists of a relay K3, single pole changeover. Comparator U3 receives voltage Vs and a reference voltage, the comparator output is sent to an amplifier which switches the relay at Tt = 15°C (288°K) ± 2°C. The relay is energized for Tt less than 15°C and de-energized for Tt greater than 15°C.

(c3) TMO output

This output activates the overspeed warning when Tt is greater than 131°C (404°K) ± 2°C. A comparator (U4) receives voltage Vs and a reference voltage and produces a positive signal for Tt greater than 131°C ± 2°C, and a negative signal for Tt less than 131°C ± 2°C. This signal is sent to the VMO circuit for activation of the overspeed warning and to a test connector for checks.

(d) Temperature sensor simulation

The operation is carried out on the ground during tests 1 and 2. Each test simulates a particular value of Tt.
For test1 simulation, Tt = 10°C (283°K) ± 1°C (lower than overspeed threshold), and for test 2, Tt = 135°C (408°K) ± 1°C (greater than overspeed threshold). The overspeed warning output enables an indirect check of Tt channel (by means of ST indicator light on the center console, panel 9-211). For each test a workshop check can be mode of the particular values of Tt, Ts and Vt at the computer output connectors.

(d1) Simulation with test 1

In test 1, relays K1 and K2 are energized. A resistance bridge determines a reference voltage repeated by amplifier U1 and applied to the temperature sensor signal output connection. This voltage corresponds to Tt = 10°C (283°K) ± 1°C. If the various computer circuits are operating correctly, the self-test indicator light on panel 9-211 must illumina-

te (correct positions of servo-controls Hp, Vc, M, IV).

(d2) Simulation with test 2

In test 2, relay K1 is energized. A two-resistor bridge produces a voltage repeated by amplifier U1. Voltage Vs obtained corresponds to Tt = 135°C (408°K) ± 1°C. The over-speed warning output gives a positive signal signifying that the Tt channel is correct. If the other computer circuits are correct, self-test indicator light illuminates.

(e) Principle of static temperature calculation

Static temperature (Ts) is calculated from total temperature and mach number. Voltage Vs = K' square root Tt is repeated by amplifier U5 and converted by a function potentiometer controlled by the mach channel. The output information square root Ts supplied is repeated by an amplifier which produces output voltage TS1.
A second function potentiometer supplied by K' square root Tt supplies true airspeed (Vt) information.

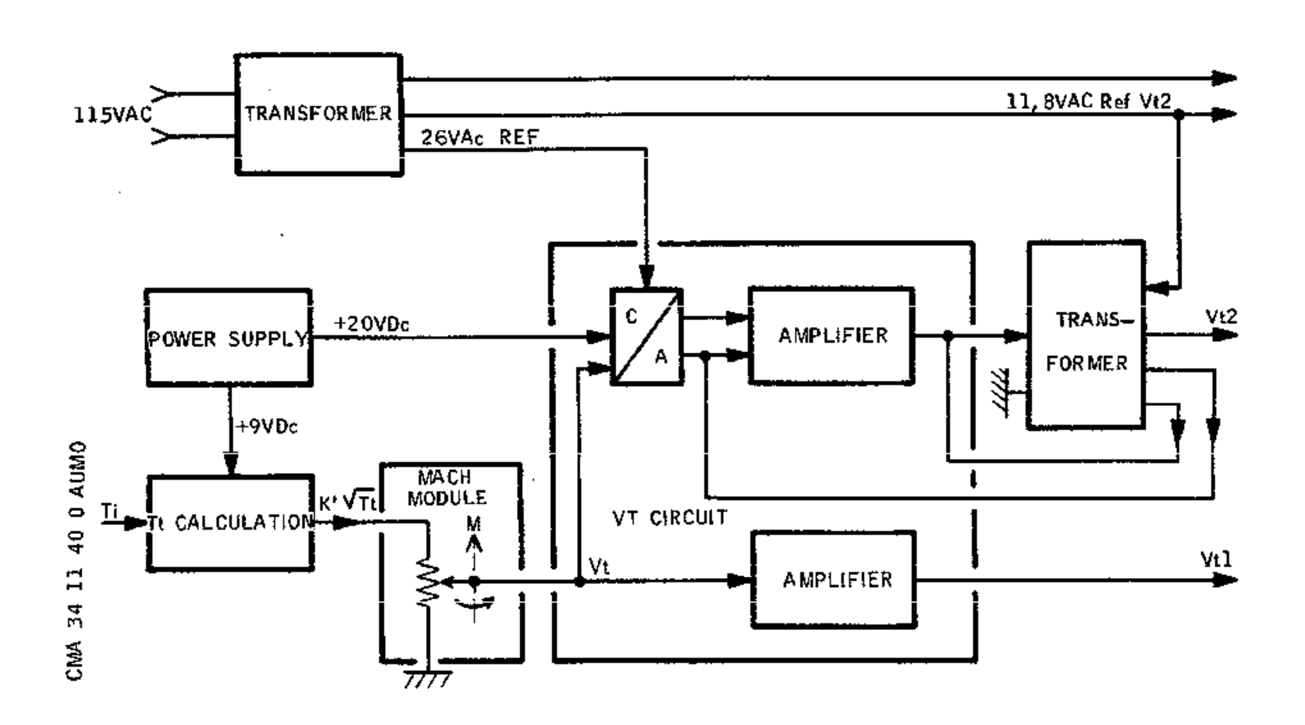
(7) True airspeed calculation channel (Ref. Fig. 010)

True airspeed (Vt) is calculated as a function of mach and total temperature from signal K' square root Tt obtained in Tt calculation channel. A function potentiometer controlled by the mach channel converts this signal to voltage Vt which enables development of Vt1 and Vt2. This voltage Vt is repeated by an impedance matching amplifier, the output of which is DC voltage Vt1.
Voltage Vt is also applied to a DC-AC converter, which receives as a phase reference, a 26VAC in phase with an 11.8VAC voltage which acts as a reference for Vt2. The AC signal information from the converter is amplified and applied to an output transformer.
The transformer ensures output impedance matching and isolates voltage Vt2 from computer ground. The output signal is in phase with the 11.8 VAC.

(8) MMO and VMO calculation channels (Ref. Fig. 011)

(a) Principles of calculation

The structural limit is a function of altitude



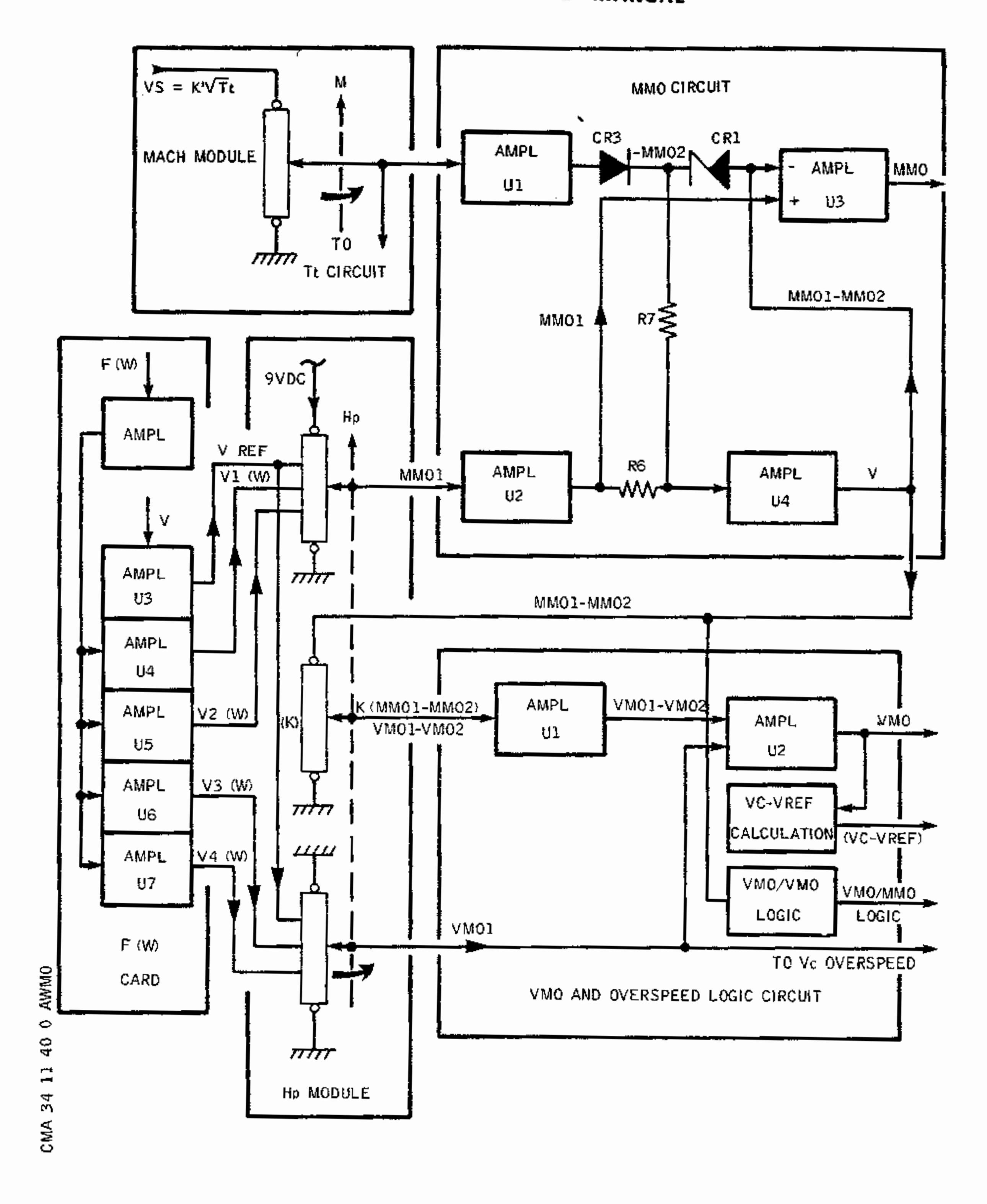
Vt Calculation Channel - Block Diagram
Figure 010

(Hp) and aircraft weight (W). It is translated, into speed by VMO1, and into mach number by MMO1. Weight information is supplied by the center of gravity computer, in the form of a DC voltage varying between 0 and 5VDC. Skin heating limit is a function of static temperature, it is expressed as a speed by VMO2, and in mach number by MMO2. For calculation of VMO and MMO the smaller of the two unit values is used : VMO1 or VMO2 and MMO1 or MMO2.

(b) MMO calculation

(b1) Generation of MMO1

A functional potentiometer is driven by the Hp channel. It is supplied by + 9VDC, + Vref, V1 (W), V2 (W) (voltages with respect to aircraft ground). Slider voltage MMO1 is thus varied as a function of (W). Amplifier U2 repeats MMO1.



MMO and VMO Calculation Channels :
Block Diagram
Figure 011

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(b2) Generation of MMO2

A function potentiometer servo-controlled by the mach channel, is supplied by the total temperature voltage Vs = K' square root Tt. The slider supplies square root Ts = MMO2 information. Voltage - MMO2 is available at the output of amplifier U1. An electronic device limits maximum allowable mach number to a voltage corresponding to MMO = 2.04.

(c) Obtaining MMO1 - MMO2

Network R6, R7, V4 forms a comparator which performs the operation V output = MMO1 - MMO2. This voltage is applied to the negative input of amplifier U3. The selection of MMO = MMO1 or MMO2 (the lower of these 2 values) is obtained as follows :

- When MMO1 is greater than MMO2 a positive voltage is applied to the positive input of U4. U4 is looped, CR1 conducts and the output voltage is applied to the negative input of U3. In these conditions U3 output is : MMO = MMO1 - (MMO1 - MMO2) = MMO2.
- When MMO1 is less than MMO2 a negative voltage is applied to the positive input of U4, U4 is in open loop condition and CR1 is cut off. Output of U4 is 0 volts. In these conditions U3 output is : MMO = MMO1 - 0 = MMO1.

(d) VMO calculation

(d1) Generation of VMO1

A functional potentiometer is servo controlled by the Hp channel. It is supplied by Vref, V3 (W), V4 (W). Slider voltage VMO1 is varied as a function of W.

(d2) Generation of K (MMO1-MMO2)

Information MMO1-MMO2 produced in the MMO circuit is sent to a function potentiometer servo-controlled by the Hp channel which translates it into K (MMO1-MMO2).
In the calculation for each altitude, the difference VMO1-VMO2 can be expressed as K (MMO1-MMO2), K being an altitude function which translates differences of mach number

into differences of speed, expressed as VMO1-VMO2 = K (MMO1-MMO2), from which is calculated VMO2 = VMO1 - K (MMO1 - MMO2).
Amplifier U1 repeats the information :
K (MMO1 - MMO2) = VMO1 - VMO2.

(d3) VMO output

Selection of the lower value of MMO1 or MMO2 is made by the MMO circuit. The difference MMO1-MMO2 is transmitted if MMO1 is greater than MMO2, that is VMO1 is greater than VMO2.
Output differential amplifier U2 supplies :
VMO = VMO1 - (VMO1-VMO2) that is VMO=VMO2.
For MMO1 less than MMO2, that is, VMO1 <
VMO2, the output of U4 is 0 volts and amplifier U2 output is VMO = VMO1

(9) Control of self tests (Ref. Fig. 012)

Tests 1, 2, 3 and 4 consist of self tests which enable checks of correct computer operation before flight.

- Tests 1 and 2 check operation of calculation and servo-control channels
- Test 3 checks monitoring operations
- Test 4 checks comparator operations

These tests can be carried out by means of controls on the computer front panel, or at the Pilot positions. Before the tests, correct operation of indicator lights must be ensured by depressing test light push-button on the computer front panel.

(10) Self tests : test 1 and test 2 (Ref. Fig. 013)

These tests enable checking, in two flight configurations, of the accuracy of calculations. Electrical simulation of input flight parameters results in the following output parameter values :

PARAMETERS	TEST 1	TEST 2
Hp (ft)	10000 ± 25	48000 ± 120
M (mach)	0.63 ± 0.005	2 ± 0.01
Vc (kts)	350 ± 3	555 ± 3
IV (degrees)	21.5 ± 0.25	3.4 ± 0.25
Tt (°C)	10 ± 1	135 ± 1
Ts (°C)	- 10.8 ± 2	- 46.4 ± 2

PARAMETERS	TEST 1	TEST 2
Vt (kt)	398 ± 6	1173 ± 20

(a) Test 1

With aircraft on the ground, the landing gear relay is energized and sends the + 28VDC level to the computer, The + 28 VDC is applied to the test 1 circuit either by means of the test selector switch at the Pilot positions, or the test 1 push-button on the computer.
It supplies the four indicator lights Hp, Vc, M and I, the Pilot self-test indicator light and the switching relays of the following circuits : Ps pickoff repeat, Qc pickoff repeat, angle of attack and total temperature.
Inputs of Ps, Qc, Iv and Tt are switched to voltage dividers which electrically simulate precise parameter values.
For correct servo control positioning a self test contact opens (removal of ground) on the Hp, M, Vc-IV modules, causing illumination of test indicator lights. If the four self test circuits are open, a logic circuit followed by a control circuit ensures illumination of the self test indicator light at the Pilot positions.

(b) Test 2

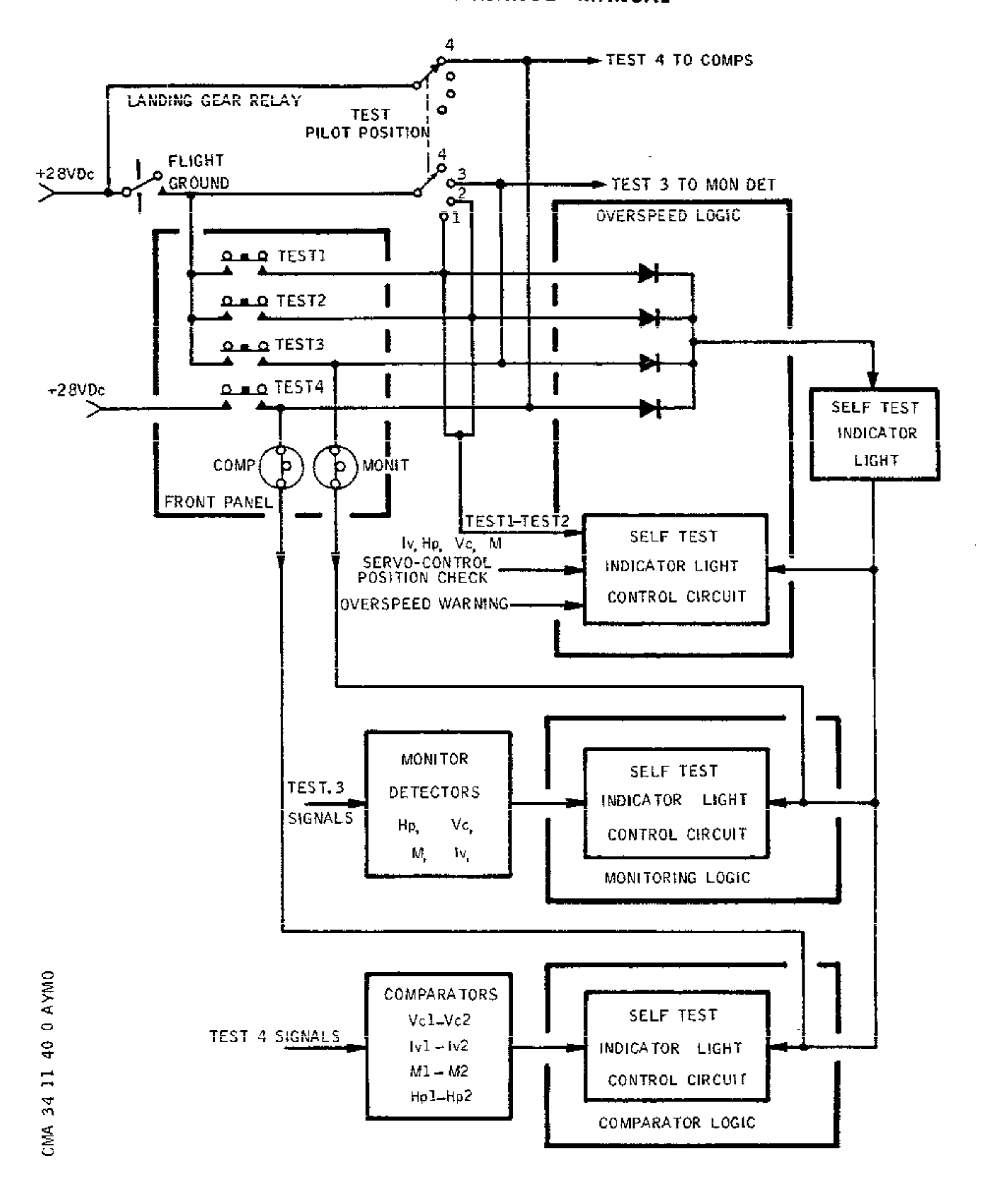
Test operation is similar to that of the preceding test, but in addition this test simulates values of Vc, M, Vc-VREF, Tt, such that the four overspeed warnings are activated and each ground the input of the overspeed logic.
Self test indicator light at the Pilot position illuminate if :

- the four self test contacts are open
- the four overspeed warnings are activated.

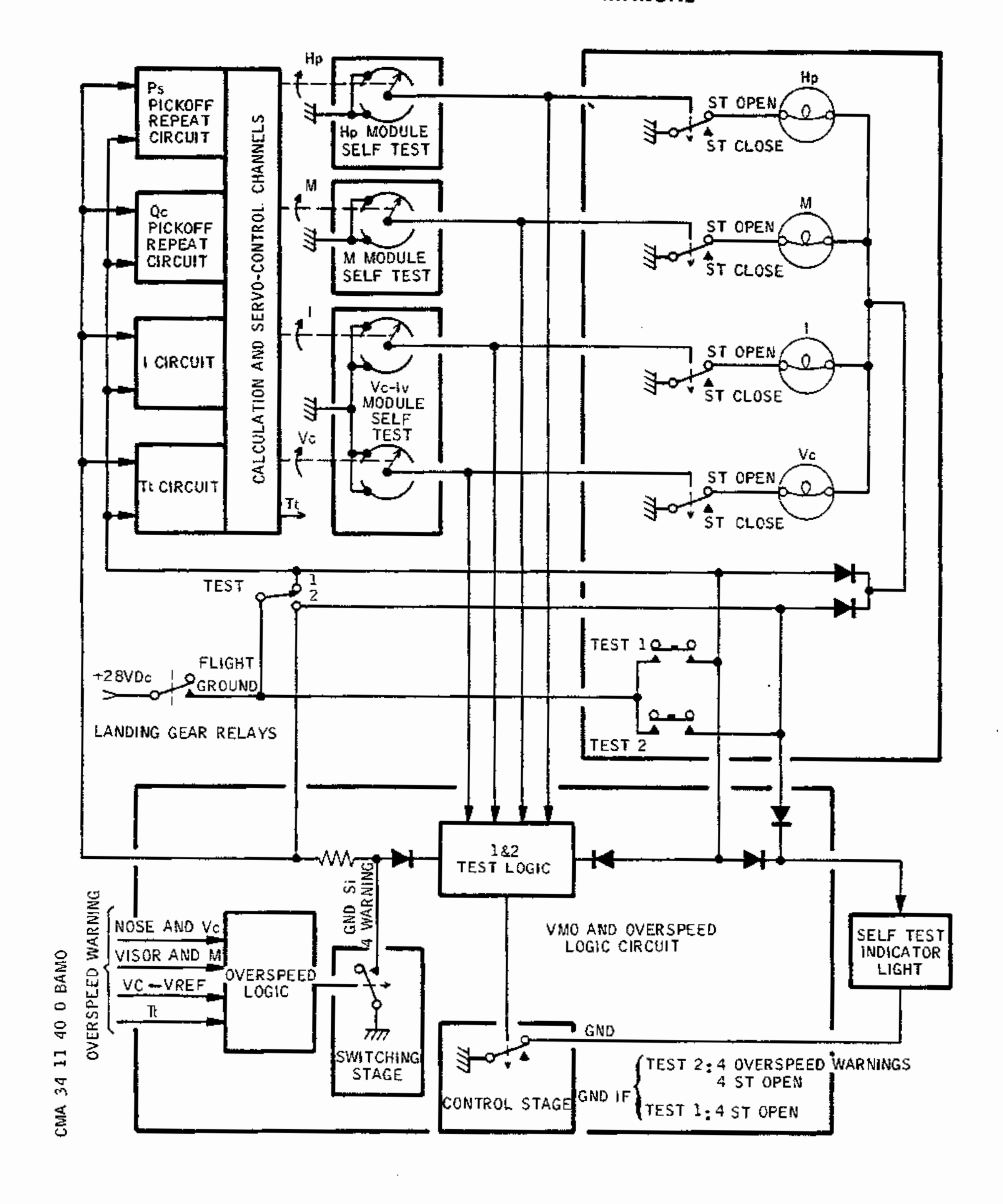
(11) Monitoring and test 3 (Ref. Fig. 014)

(a) Principle

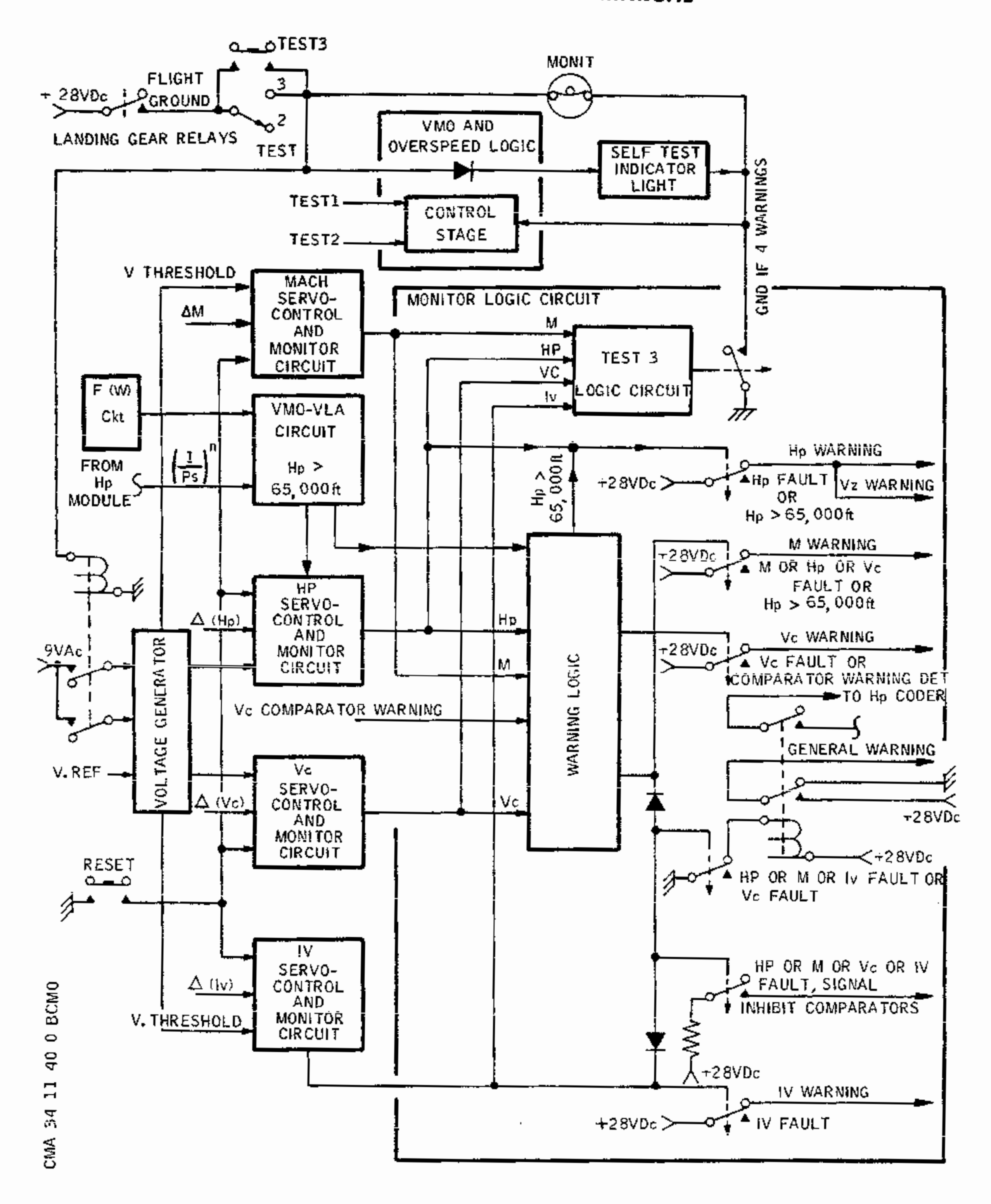
The monitor system continuously checks the servo control error signal level. A repeat fault causes an increase in signal level which causes activa-



Self Tests : Operational Block Diagram
Figure 012



Operation Block Diagram of Tests 1 and 2
Figure 013



Operation Block Diagram of Monitors and Test 3
Figure 014

tion of a warning when a fixed comparison threshold in exceeded.
A 2 second time delay is incorporated in order to avoid unnecessary activation of the warning.
The monitored calculation channels are :

CHANNELS MONITORED	ERROR LEVEL AT OUTPUTS	TOLERANCE
Altitude (Hp)	± 100ft at 0ft altitude	± 40%
Calibrated airspeed (Vc)	± 6 kts at Vc = 200 kts	± 35%
Mach (M)	± 0.0275 at M = 0.5	± 25%
Angle of attack	± 1°	± 25%

(b) Warning activation conditions

Altitude (Hp), vertical speed (Vz) and mach (M) warnings are activated when altitude exceeds 65000 ft.

- a fault in the angle of attack calculation channel activates IV warning
- a fault in the altitude calculation channel activates Hp and Vz warnings
- A fault in the mach, altitude or speed calculation channels activates the mach warning
- Upon detection of Vc comparator warning, or calibrated airspeed (Vc) channel fault, Vc warning is activated
- The general warning is activated in case of a fault in one of the Hp, M, Vc, or IV calculation channels
- Comparators are inhibited when a fault occurs in one of the four monitored channels.

(c) Operation

Each calculation channel produces a logic signal at the servo control and monitor circuit output, depending on the servo error signal level. Each monitor warning is stored and can only be reactivated by reset action at the Pilot positions.
A monitor logic circuit enables activation of warnings according to the conditions previously defined. Activation is made by cutting off a + 28VDC voltage. A comparator inhibit signal is sent when a warning is activated.

(d) Altitude warning for Hp greater than 65000 ft.

The signal (1/PS) from the Hp module is a function of altitude. It is applied to a comparator in the VMO-VLA circuit which sends a warning signal when Hp exceeds 65000 ft to the following circuits :
- to the monitor logic which activates the Hp, Vz and M warnings
- to the Hp servo-control and monitor circuit, thus avoiding activation of the general warning for an altitude greater than 65000 ft.

(e) Test 3

The purpose of this test is to check correct operation of the monitor circuits. The +28VDC applied by the test 3 push-button, or by the test selector switch supplies the monitor indicator light, self test indicator light and the power supply circuit relay. The AC signal sent by the relay activates monitor detectors IV, Hp, H1 and Vc. The logic signals obtained at the output enables warning activation. The self-test and warning lights illuminate if the four conditions IV, Hp, M and Vc occur together.

(12) Hp, M, IV and Vc comparison channels (Ref. Fig. 015)

(a) Comparator principle

The purpose of the comparators is to check agreement between the information from the two computers, comparing altitude (Hp), mach (M), angle of attack (IV) and calibrated airspeed (Vc) outputs. Altitude, mach and angle-of-attack comparators are located in air data computer 1. Calibrated airspeed comparator is in air data computer 2.
The following table shows levels and conditions necessary for warning activation.

COMPARISONS	LEVELS AND CONDITIONS	WARNINGS
Hp1 - Hp2	at - 1000 ft : 250 ft at 10000 ft : 250 ft at 40000 ft : 520 ft at 60000 ft : 800 ft	Comparator main warning
M1 - M2	from 0.25 to 2.5M : 0.07M	Comparator main warning

COMPARISONS	LEVELS AND CONDITIONS	WARNINGS
IV1 - IV2	from - 10° to + 25° : 2°	Comparator main warning. Angle of attack comparator warning
VC1 - VC2	at 50kts : 17 kts at 100 and 200kts : 9 kts at 600kts : 19.4kts	Comparator main warning Calibrated airspeed comparator warning

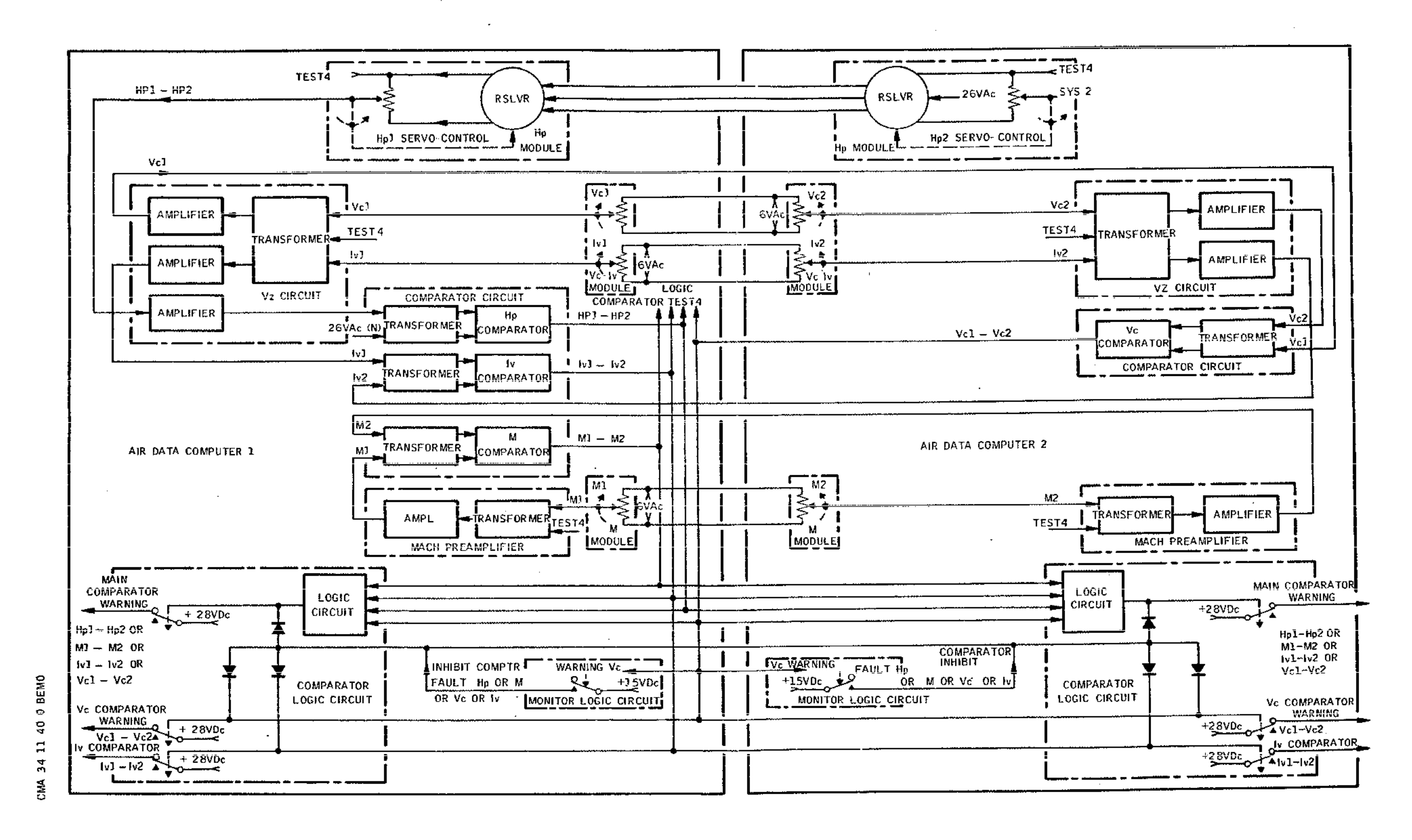
NOTE 1 : The time delay of Hp1-Hp2, M1-M2 and Vc1-Vc2 comparison warnings is 3 ± 0.6 seconds, that of IV1-IV2 comparison 1.8 ± 0.25 seconds.

NOTE 2 : Where comparator Vc detects that a comparator threshold level has been exceeded, monitor warnings Vc on both computers are activated.

(b) Operation of Hp comparator

Altitude signal of comparator 2 is developed from a resolver acting as a transmitter, of which the rotor is driven by HP2 servo control.
Computer 1 resolver operates as a receiver, its rotor, driven by Hp1 servo control, supplies a difference signal Hp1 - Hp2. According to the required comparison level which is a function of altitude, a portion of this difference is taken from a potentiometer controlled by altitude channel Hp1. Hp1 - Hp2 information is sent to the Hp comparator through vertical speed amplifier V2 and a transformer. The comparator establishes a negative signal when the difference of Hp1 - Hp2 passes the fixed threshold.
This signal is sent to each computer comparator logic circuit.

(c) Operation of comparators VC1 - VC2, IV1 - IV2,



Comparison Channel Operation
Figure 015

M1 - M2.

These comparators operate in an identical manner. The parameters are developed from potentiometers driven by the servo channels. The difference between parameters is obtained by means of transformers and each comparator detects if this difference is greater or less than the fixed threshold The comparator outputs are connected to the comparator logic circuits of the two computers.

(d) Comparator logic

When the comparator warnings are not inhibited, the main warning is activated if one of the four comparators detects a deviation between the two computers. Vc and IV warnings are also activated in case of a deviation. All the warnings can be inhibited by the monitor logic positive signal in case of in altitude, mach, angle of attack or calibrated airspeed fault.

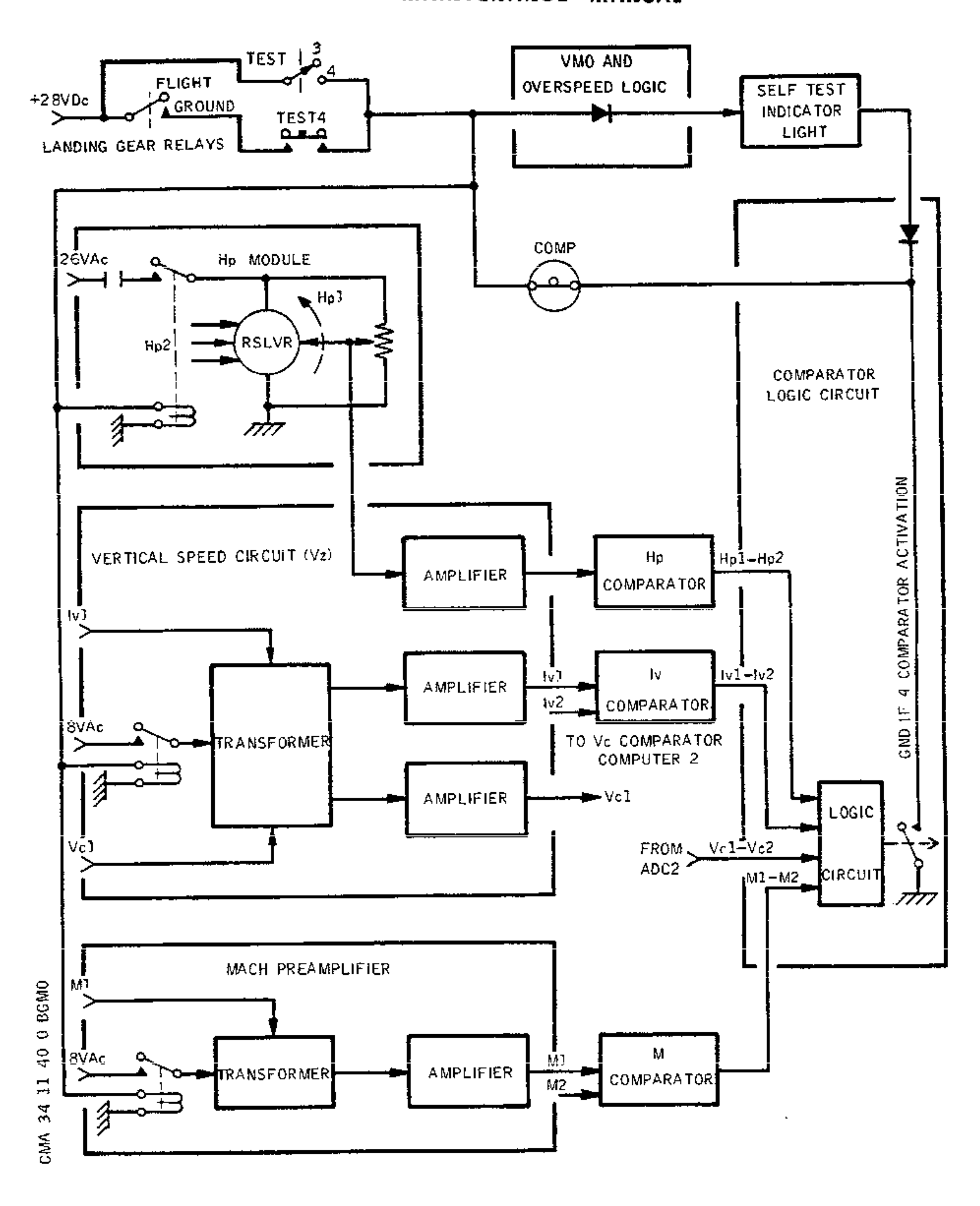
(13) Comparator Test

(a) Test 4, ADC1 (Ref. Fig. 016)

Test 4 enables a check of correct operation of the comparators. A +28VDC level applied by means of the test selector switch, or by test 4 push-button supplies the self test indicator lights, comparator and three relays. Each relay switches an AC voltage for the operation test.
The AC signal received by Hp module potentiometer replaces difference signal Hp1 - Hp2 and enables activation of Hp comparator.
For activation of Vc, IV and M comparators, two transformers produce voltage levels higher than the comparison level. The comparator logic circuit causes illumination of two indicator lights when the four comparators are activated.

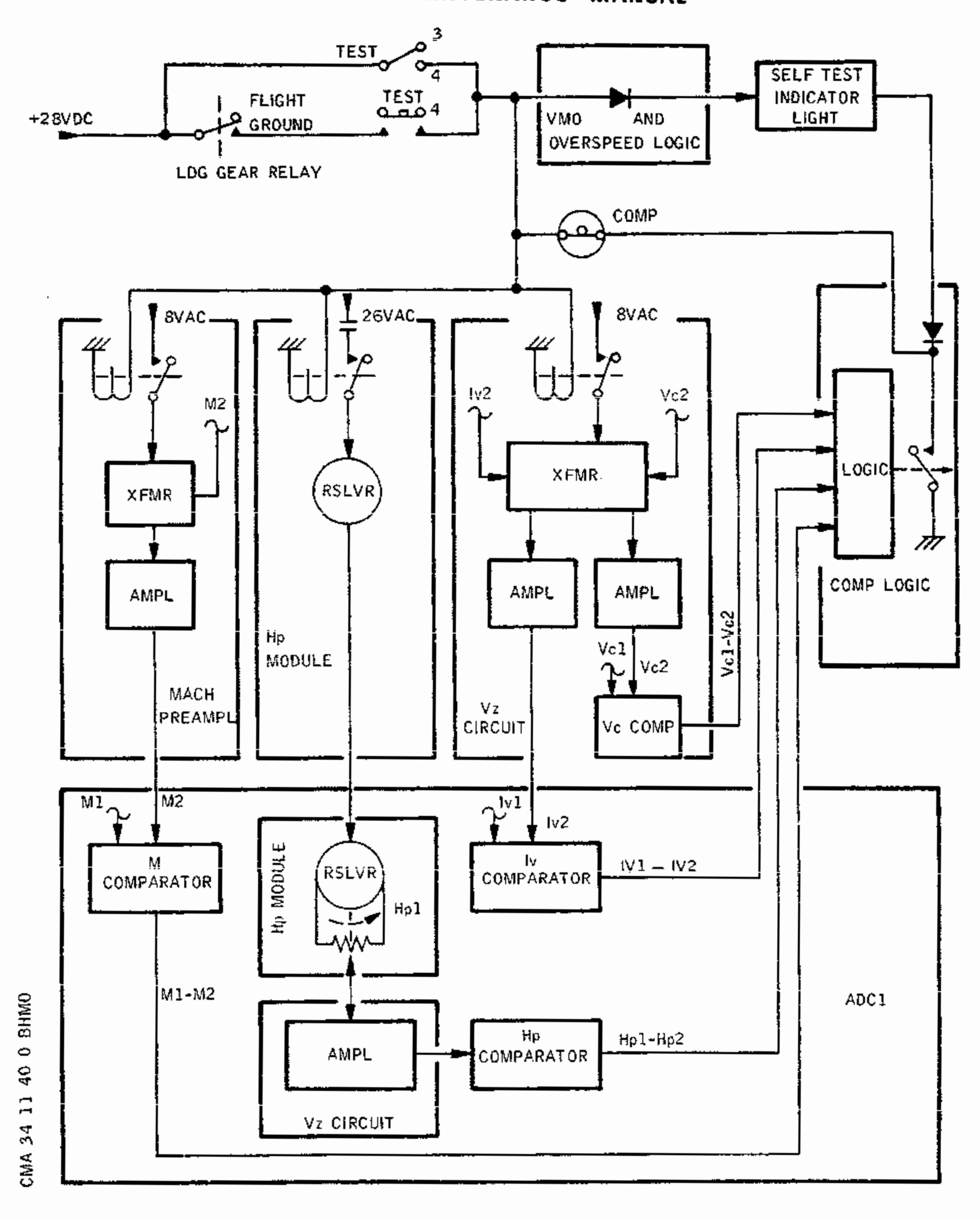
(b) Test 4, ADC2 (Ref. Fig. 017)

The test operates as for test 4 of ADC1. The Hp1-Hp2 comparator receives an AC signal, phase-shifted by capacitance and sent through the chain of two resolvers. Its amplitude and phase are such that the Hp1-Hp2 comparator changes state. Illumination of the self-test and COMP indicator lights depends on triggering of the four comparators.



Block Diagram of Test 4, ADC1
Figure 016

R



Block Diagram of Test 4, ADC2
Figure 017

R

(14) Overspeed warning and Vc - VREF outputs (Ref. Fig. 018)

The general overspeed warning produced by an interruption of the ground connection is activated by one of the following conditions :

- If the total temperature (Tt) is greater than 404°K (131°C) ± 1° K.
- If calibrated airspeed (Vc) exceeds VMO1 by 6kt ± 1.6 kt
- If Vc is greater than 270kt ± 2.5 kt when the nose is in the down position
- If mach is greater than 0.95 ± 0.008 when visor is in down position. These conditions of overspeed warning activation are also applied to test 2 overspeed logic.
  Output Vc-VREF is generated by a stage which takes the difference of the signals. VREF is calculated from a reference mach number.
  Signal Vc is produced by a potentiometer servo controlled by the Vc calculation channel. An amplifier compares VMO with Vc - 6 kt, the 6 kt deviation is obtained through a resistor (R16). VMO/MMO Logic Output is produced from VMO calculation stage through an output stage.

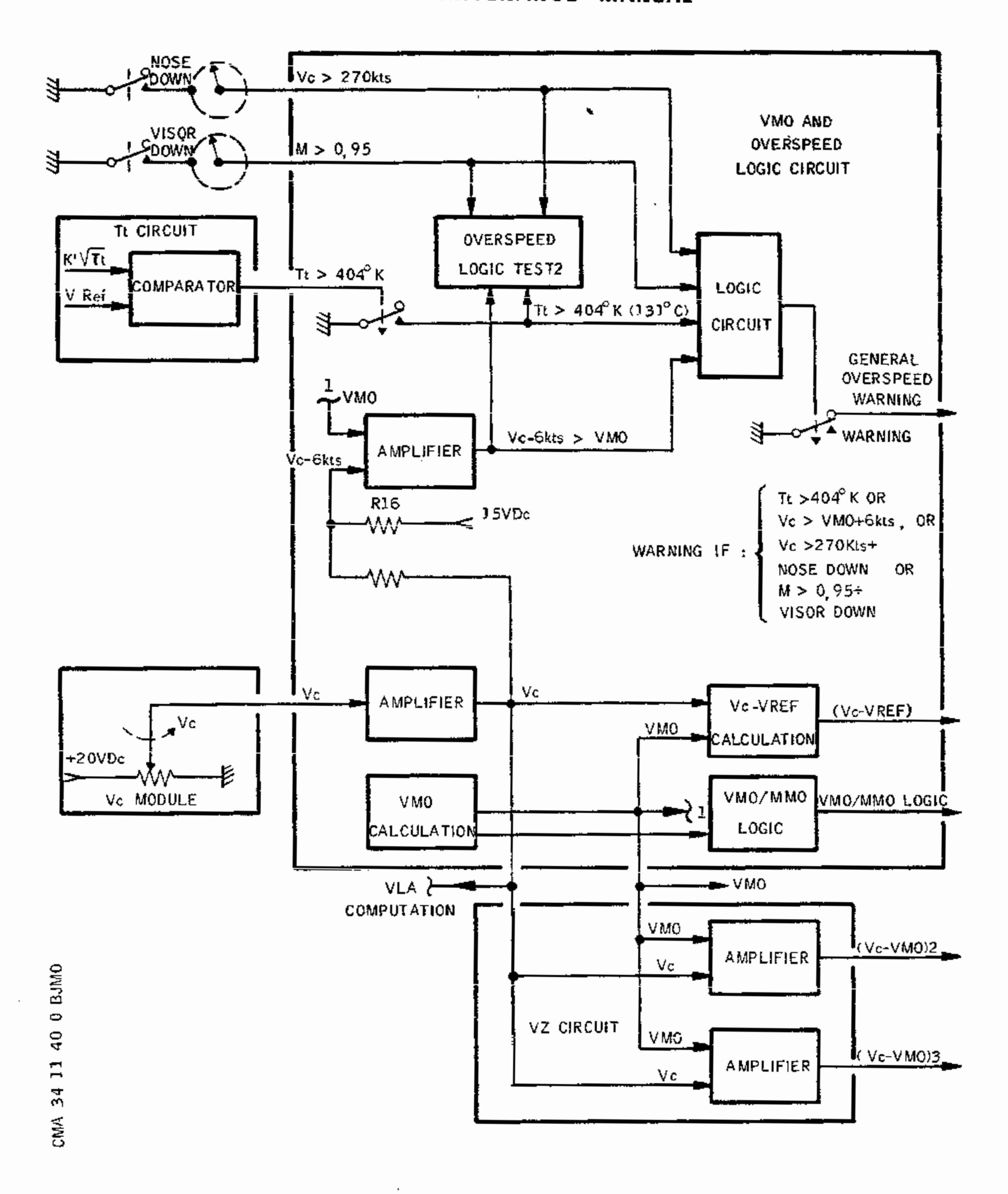
(15) Blocking circuit

The purpose of this circuit is to compensate for a transient interruption of the 115VAC supply, which cuts the + 28VDC and ± 15VDC produced by the computer. Loss of + 28VDC causes warning activation (monitors and comparators) and their indications at the Pilot positions.
Presence of a + 28VDC voltage produced by the blocking circuit avoids warning activation during a brief loss of power. The delayed voltage level remains in operation for 1.25 seconds.

(16) Chopper signals

The signals are produced by the chopper and blocking control circuit, by means of AC voltages.
Square wave signals S'1 and S'2, in phase opposition are used in Hp, in and Vc calculation channels.
Signals S1 and S2, similar to the preceding signals are used in Hp and Vc calculation channels.

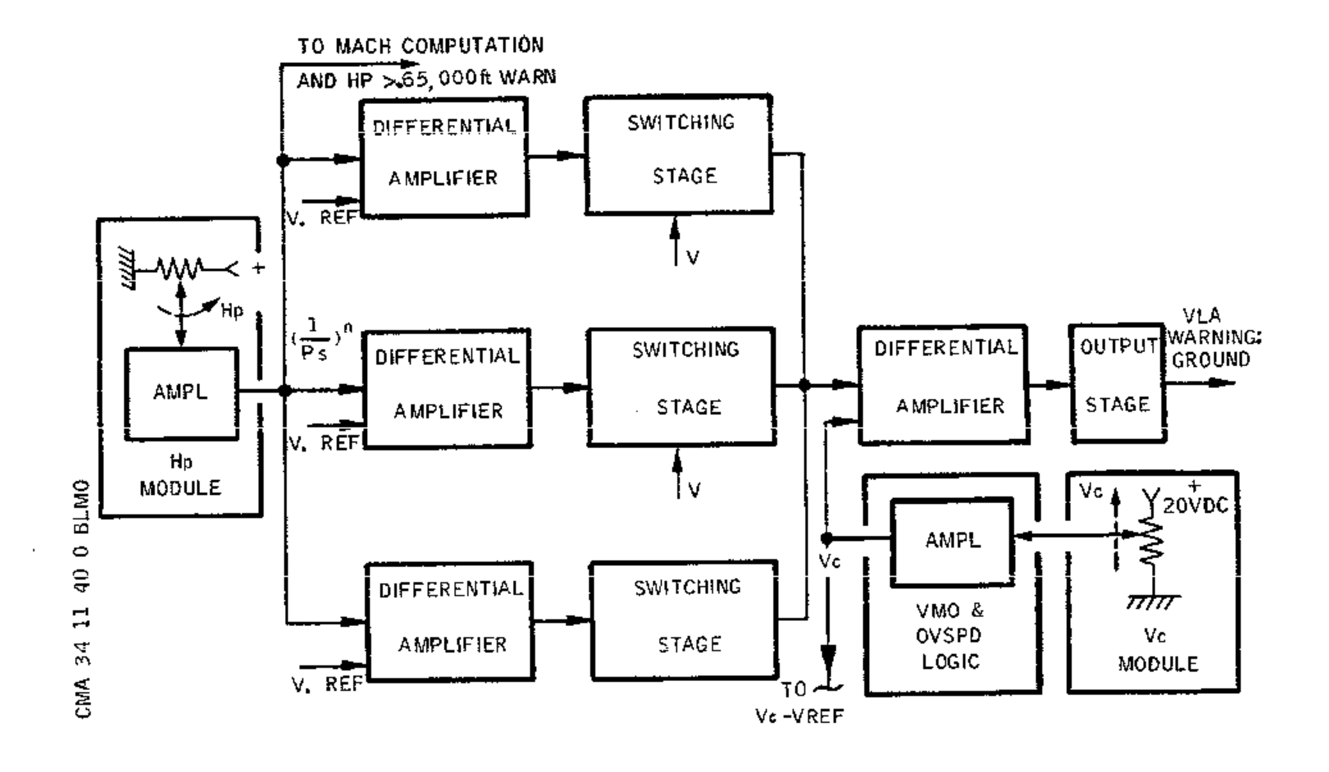
(17) Power supply



Block Diagram of Overspeed Warning and
Vc-VREF Outputs
Figure 018

The computer is supplied by 115VAC, 400Hz used to supply the necessary AC and DC voltages. + 28VDC from the aircraft network is also supplied for warnings and self tests.

(18) Minimum allowable airspeed (Ref. Fig. 019)



Minimum Allowable Airspeed (VLA) :
Block Diagram
Figure 019

A potentiometer controlled by the altitude channel produces a signal which is sent to three amplifiers operating at three different threshold levels. A differential amplifier compares the output signals with a calibrated airspeed signal. The output stage establishes a ground connection when Vc becomes less than VLA by more than 20kts ± 3kts. A computer power supply failure does not activate a warning.

ALTITUDE (Hp)	Vc	VLA	OUTPUT
25000 ft to 43000 ft	Vc less than or equal to 230kts	250kts	ground
43000 ft to 63000 ft	Vc less than or equal to 280kts	300kts	ground
63000 ft to 65000 ft	Vc less than or equal to 380kts	400kts	ground

AIR DATA COMPUTER - MAINTENANCE PRACTICES

1. Leak Checks

A. A leak check must be performed if :

(1) More than one pitot and one static quick release connection is disturbed in one main system e.g. No.2 ADC and No.3 or No.4 Air Intake Sensor Unit.

(2) Any quick release connections in both main pitot/static systems are disturbed (both systems must be leak checked) e.g. interchange of ADC's.

(3) Any pitot/static connections, other than the quick release type are disturbed in any pitot/static system e.g. Pitot Heads, Static Vents and Drain Taps.

B. No leak check is required if only one pitot and one static quick release connections on only one system are disturbed e.g. a single ADC change.

AIR DATA COMPUTER REMOVAL/INSTALLATION

CAUTION : OBSERVE THE PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

Removal/installation for replacement of air data computer (ADC) or of one of the components installed at rear of shelf.
Two ADCs (1F71 and 2F71) are installed in an identical manner in the electronics racks, on shelves 6-215 and 6-216 respectively. A single removal/installation procedure will therefore be described.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Ventilation Outlet Blanking Plate	
Blanking Plugs for Air Data Lines	

B. Prepare

(1) On center console, panel 9-211, make certain on ADC control panel that

(a) ADC1 and ADC2 switches are in OFF position.

(b) TEST selector switches are in NORM position.

(2) Trip, safety and tag the following circuit breakers :

(a) For ADC1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
"E" SCHD SUP 1	1-213	K 34	E 7
ADS1 PROBE HTRS CONT		1H 1	K 8
LH UC WEIGHT SW "A" SYS SUP		G 292	M17
ADC1 28V SUP		1F 74	P12

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
AT1 CONT		1C 180	Q12
AUDIO WARN O/SPEED SUP1		W 374	S19
ADC1 26V SUP	2-213	1F 78	A 2
STBY1 CG LIMITS & CG COMPN SUP		Q1361	A24
1ST PLT ADC INST SUP		1F 75	B 3
AP/FD SYS 1 SUP		1C 20	C 5
YAW ART FEEL COMP 1 SUP		1C 242	E 2
ROLL ART FEEL COMP 1 SUP		1C 243	E 3
PITCH ART FEEL COMP 1 SUP		1C 244	E 4
AUTO STAB 1 COMP SUP		1C 37	E 5
ADC1 115V SUP		1F 73	F 3
FLT TEST 115VAC SUP	4-213	X 481	B22
AT SYNCHRO SYS1 SUP	13-215	1C 181	D 5
TRIM SYNCHRO SYS1 SUP		1C 163	E 5

(b) For ADC2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS2 PROBE HTRS CONT	3-213	2H 1	A11
"E" SCHD SUP 2		K 35	B 3
RH UC WEIGHT SW "B" SYS SUP		G 294	B 9
STBY2 CG LIMITS & CG COMPN SUP	4-213	Q1357	B 2
AT2 CONT	5-213	2C 180	A14
AUDIO WARN O/SPEED SUP2		W 373	C18
ADC2 28V SUP		2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
TRIM SYNCHRO SYS2 SUP		2C 163	A16
AP/FD SYS2 SUP		2C 20	A17
AT SYSNCHRO SYS2 SUP		2C 181	B17
FLT TEST 26VAC SUP		X 480	B18
AUTO STAB 2 COMP SUP		2C 37	D17
ADC2 26V SUP		2F 78	F14
ADC2 115V SUP		2F 73	F15

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
YAW ART FEEL COMP2 SUP		2C 242	G16
ROLL ART FEEL COMP2 SUP		2C 243	G17
PITCH ART FEEL COMP2 SUP		2C 244	G18

(3) On electronics rack

(a) For ADC1 (1F71), remove panel 215BS to gain access to shelf 6-215.

(b) For ADC2 (2F71), remove panel 216BS to gain access to shelf 6-216.

C. Remove

NOTE : Take precautions as air data computer weighs approximately 21kg (46.30 lb.).

(1) Disconnect flexible static line quick disconnect connector from ADC STATIC connector and connect to its stowage connector.

(2) Disconnect flexible pitot line quick disconnect connector from ADC PITOT connector and connect to its stowage connector.

(3) Plug ADC STATIC and PITOT connectors.

(4) Carry out operations described in 34-00-00, Removal/ Installation, paragraph 2.D. (2).

(5) On removed ADC

(a) Check period of operation on elapsed time counter.

(b) Make certain that test connector is capped.

D. Preparation of Replacement Component

(1) Make certain that rack is clean and that its connectors are in correct condition.

(2) Make certain on replacement component that

(a) Exterior is in correct condition.

(b) STATIC and PITOT connectors are in correct condition.

(c) Test connector is capped.

(d) Rear connectors are intact, with no trace of corrosion.

NOTE : Note of operation on elapsed time counter, if applicable.

E. Install

(1) Carry out the operations described in 34-00-00, Removal/Installation, paragraph 2.F. (2).

(2) Remove blanking plugs from ADC STATIC and PITOT connectors.

(3) Disconnect flexible pitot line quick disconnect connector from its stowage connector, and connect to ADC PITOT connector.

(4) Disconnect flexible static line quick disconnect connector from its stowage connector, and connect to ADC STATIC connector.

F. Close-Up

(1) Remove safety clips and tags and reset the circuit breakers tripped in paragraph 2. B. (2) (a) or 2. B. (2) (b).

(2) Carry out an ADC test (Ref. 34-11-41, Adjustment/Test).

(3) On relevant electronics rack, install panel 215BS or 216BS.

AIR DATA COMPUTER - ADJUSTMENT/TEST

1. General

This test shall be carried out after removal/installation or replacement of an air data computer (ADC).
This test shall be carried out from test panel at front of ADC.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

NOTE : The aircraft shall be in GROUND configuration, with shock absorbers compressed.

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics racks ventilation system (Ref. 21-21-00).

(3) On Captain and First Officer instrument panels, on airspeed indicators and altimeters, make certain that selector knob is in N position and that ADC marker is visible in annunciator.

(4) On altimeters, use bars set knob in lower LH corner to set a barometric pressure of 1013 mb (29.92 in. Hg.).

C. Test

(1) On centre console panel 9-211, on ADC control panel.

(a) Make certain that test selector switches are in NORM position.

(b) Place ADC1 or ADC2 ON-OFF switch in ON position.

(c) After approximately 30 seconds, press and release amber ADC1 or ADC2 warning light, which remains

extinguished.

(2) On test panel on front of ADC

(a) Press TEST LIGHT push-button
- HP, VC, M, I, MONIT and COMP indicator lights illuminate.

(b) Release TEST LIGHT push-button
- these six indicator lights extinguish.

(c) Press and hold TEST1 push-button.

NOTE : If stick shaker is not needed during test, trip circuit breaker W513, panel 1-213, map ref. P15.

(c1) After a few seconds, HP, VC, M and I indicator lights illuminate.

(c2) After a few seconds, on ADC control panel blue TEST indicator light system in operation illuminates.

(c3) In flight compartment, Captain and First Officer control columns shake and aural warning sounds (unless circuit breaker W513 has been tripped).

(c4) If applicable, check the following information on Captain or First Officer instrument panel :

INSTRUMENTS	PARAMETERS	VALUES
Altimeter	Hp in ft.	10,000 ± 30
Airspeed indicator	Vc in kt	350 ± 3
Machmeter	M	0.63 ± 0.01
Angle of attack indicator	alpha in (°)	21.5 ± 0.5
Temperature indicator	Tt in (°C)	10 ± 2
	Ts in (°C)	-11 ± 2,5
	ISA in (°C)	-6.2 ± 3.5

(d) Release TEST1 push-button

(d1) HP, VC, M and I indicator lights extinguish.

(d2) On ADC control panel, blue TEST indicator light of system concerned extinguishes.

(d3) Captain and First Officer control columns stop shaking and horn aural warning stops (if stick shaker was operating).

(d4) Instruments again display their initial values.

(e) Press and hold TEST2 push-button.

NOTE : - If droop nose is not positioned at 12.5°, blue TEST indicator light will not illuminate and overspeed warning will not operate.
- Press and release amber ADC warning light of system in operation (on ADC control panel).

(e1) After a few seconds, HP, VC, M and I indicator lights illuminate.

(e2) On ADC control panel, blue TEST indicator light of system considered comes on, then overspeed aural warning sounds (if droop nose is in 12.5° position).

(e3) If applicable, check the following information on Captain or First Officer instrument panel :

INSTRUMENTS	PARAMETERS	VALUES
Altimeter	Hp in ft.	48,000 ± 120
Airspeed indicator	Vc in kt	555 ± 4
Machmeter	M	2 ± 0.01
Angle of attack indicator	alpha in (°)	3.4 ± 0.5
Temperature indicator	Tt in (°C)	135 ± 2
	Ts in (°C)	-46.5 ± 25
	ISA in (°C)	10 ± 3.5

(f) Release TEST2 push-button.

(f1) HP, VC, M and I indicator lights extinguish.

(f2) Blue TEST indicator light extinguishes and overspeed warning stops (if droop nose is in 12.5° position).

(f3) Instruments again display their initial values.

(g) Press and hold TEST3 push-button.

(g1) After a few seconds, MONIT indicator light illuminates.

(g2) On ADC control panel, blue TEST indicator light and amber ADC warning light of system in operation illuminate.

(g3) On master warning panel (panel 4-211), amber ADC warning light illuminates and gong aural warning sounds.

(g4) If applicable, check on instruments of system considered that warning flags are visible on
- airspeed indicator, machmeter, altimeter, angle of attack indicator, vertical speed indicator and temperature indicator (except for STATIC and TOTAL flags).

(h) Release TEST3 push-button.

(h1) MONIT indicator light extinguishes.

(h2) On ADC control panel, blue TEST indicator light extinguishes.

(h3) On master warning panel, amber ADC warning light extinguishes, and aural warning stops.

(h4) On ADC control panel, press and release amber ADC warning light of system in operation.

(h5) Warning flags on instruments disappear.

(i) On centre console panel 9-211, on ADC control panel.

(i1) Place ON-OFF switch of system not in operation in ON position.

(i2) After 30 seconds, press and release amber ADC1 and ADC2 warning lights. These remain extinguished, and warning flags on air data instruments on Captain and First Officer instrument panels remain out of view.

(j) On test panel on ADC previously used, press and

hold TEST4 push-button.

(j1) After a few seconds, COMP indicator light illuminates.

(j2) On master warning panel, red ADS warning light illuminates and gong aural warning sounds approximately every 10 seconds.

(j3) On Captain and First Officer instrument panels, on airspeed indicators, warning flags are visible.

(j4) On ADC control panel, blue TEST indicator light of system checked illuminates.

(k) Release TEST4 push-button.

(k1) COMP indicator light extinguishes.

(k2) On master warning panel, red ADS warning light extinguishes and gong aural warning stops.

(k3) On Captain and First Officer airspeed indicators, warning flags disappear.

(k4) On ADC control panel, blue TEST indicator light extinguishes.

D. Close-Up

(1) On centre console panel 9-211, on ADC control panel, place ADC1 and ADC2 ON-OFF switches in OFF position.

(2) On panel 1-213, reset circuit breaker W513, map ref. P15 (if previously tripped).

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

SIDESLIP - DESCRIPTION AND OPERATION

1. General

R The sideslip vanes are not connected to the ADC computers.
R Output of a sensor is generated on two potentiometers.
R System 1 sensor outputs are connected as follows :

R - POT 1 Captain sideslip indicator
R - POT 2 SERAC recorder

R System 2 sensor outputs are connected as follows :

R - POT 1 First Officer sideslip indicator
R - POT 2 Sensor units 3 and 4 of air intake system, however
R this output is not used and the potentiometer has no voltage
R supply.

2. System Components

System 1 installation comprises :

- One angle of sideslip sensor (1F92).
- One sideslip indicator (1F84).

System 2 installation comprises :

- One angle of sideslip sensor (2F92).
- One sideslip indicator (2F84).

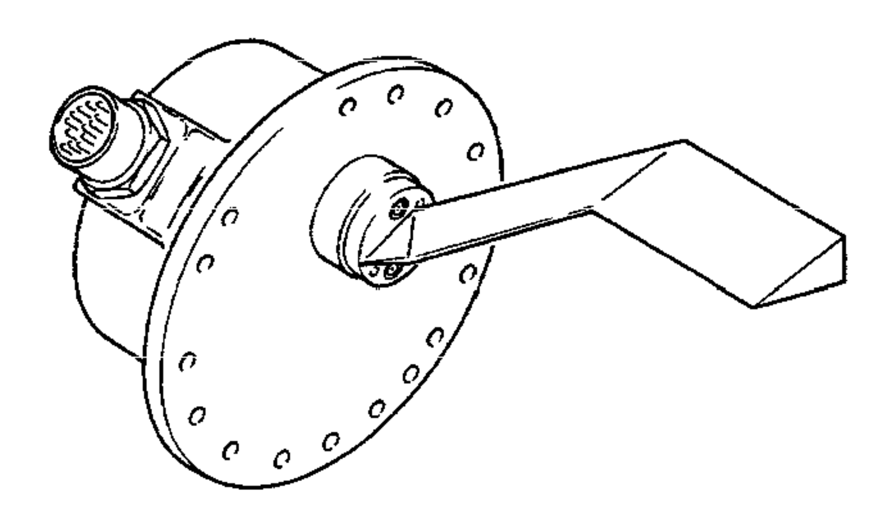
3. Angle of Sideslip Sensor (Ref. Fig. 001)

A. General

The sensor is a precise wind force measuring instrument.
It measures the angle formed by the direction of an air-
flow with an arbitrary reference line, and supplies output
R information proportional to this angle by means of two
R potentiometers. These potentiometers transmit the infor-
R mation to the recopy circuits.
De-icing is achieved by a heating element incorporated in
the sensor vane.

B. Description - Operation

The sensor elements are installed in a case. During a
sideslip, rotation of the vane (external to the case)
R changes the position of the two potentiometer sliders, ge-
R nerating the same value of output information.
R POT 1 output is used for the sideslip indicators



CMA 34 12 00 0 AAM0

Angle of Sideslip Sensor : View of Instrument
Figure 001

POT 2 output is used for the recopy circuits.

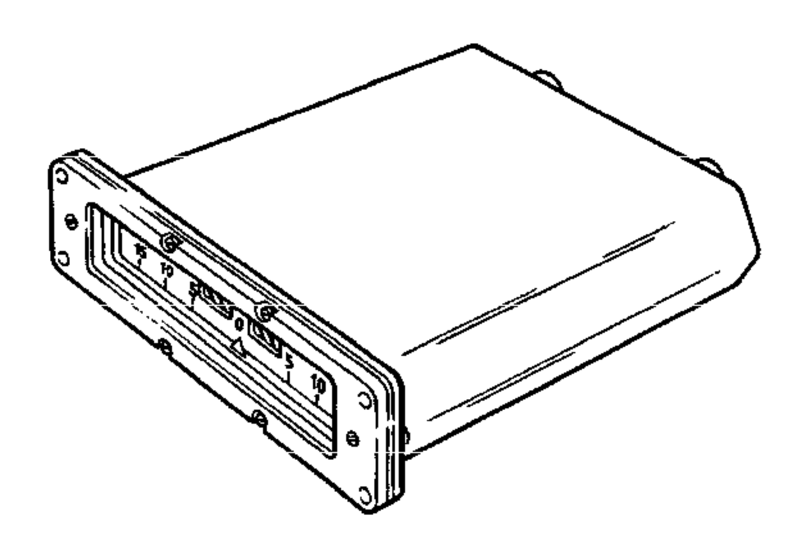
4. Sideslip Indicator (Ref. Fig. 002)

A. General

The sideslip indicator is a repeater instrument which gives visual sideslip indications from the sideslip sensor by means of a pointer moving across a horizontal scale.
A monitor circuit controls the action of two failure flags, which appear in case of a servo fault or loss of instrument power.

R B. Description - Operation (Ref. Fig. 003)

The main elements are a mechanical and an electrical module. The front of the mechanical module consists of an illuminated dial, a pointer and two warning flags. Two connectors are mounted on the rear panel.
The sideslip signal comes from the potentiometer controlled by the sideslip sensor vane. This potentiometer is supplied with a reference voltage from the indicator. Comparison of



CMA 34 12 00 0 ACMO

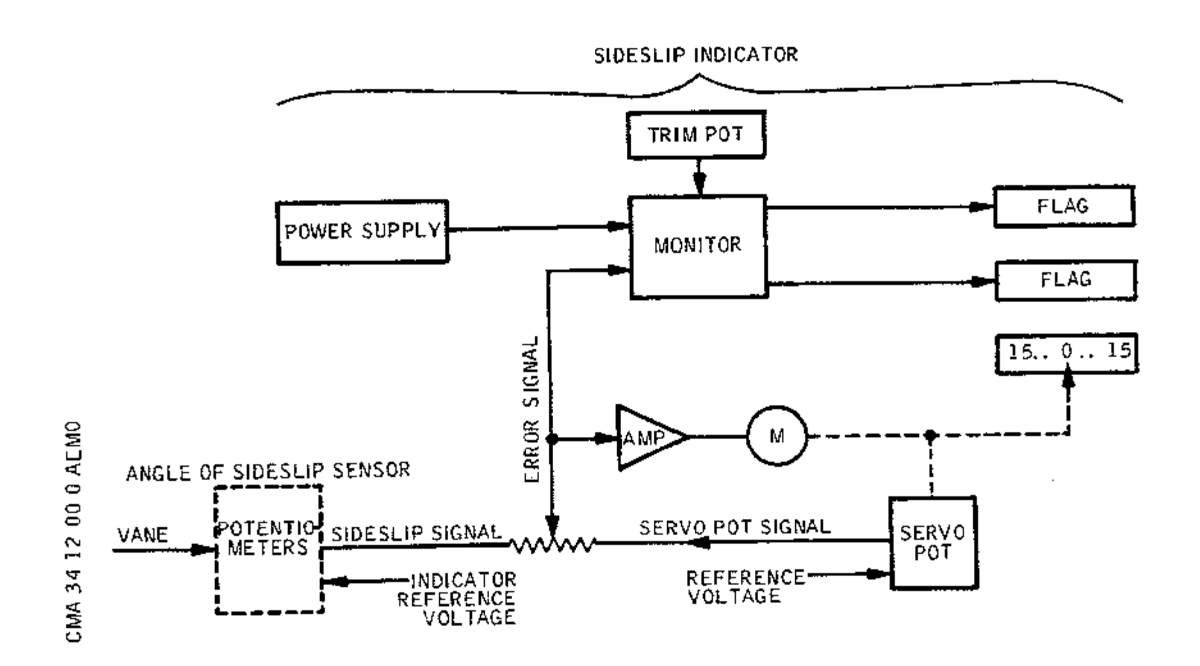
Sideslip Indicator : Front Panel
Figure 002

this voltage with the indicator servo-potentiometer voltage produces an error signal. This signal, amplified and delayed, drives the pointer positioning motor, giving a visual sideslip indication.
Simultaneously the motor drives the servo-pot to null the error signal. On termination of the sideslip condition, the error signal, which is the difference in potentiometer voltages, is amplified and drives the motor in the opposite sense, bringing the pointer to zero.
The monitor circuit monitors the error signal and power supply and causes the flags to appear in case of a fault in these circuits. The monitor activation threshold can be adjusted by means of a trimpot on the rear of the instrument.

R 5. General Operation (Ref. Fig. 004)

The sideslip assembly consists of 2 systems, only system 1 will be described.

A. Sideslip



R Sideslip Indicator : Operation Block Diagram
Figure 003

(1) System 1

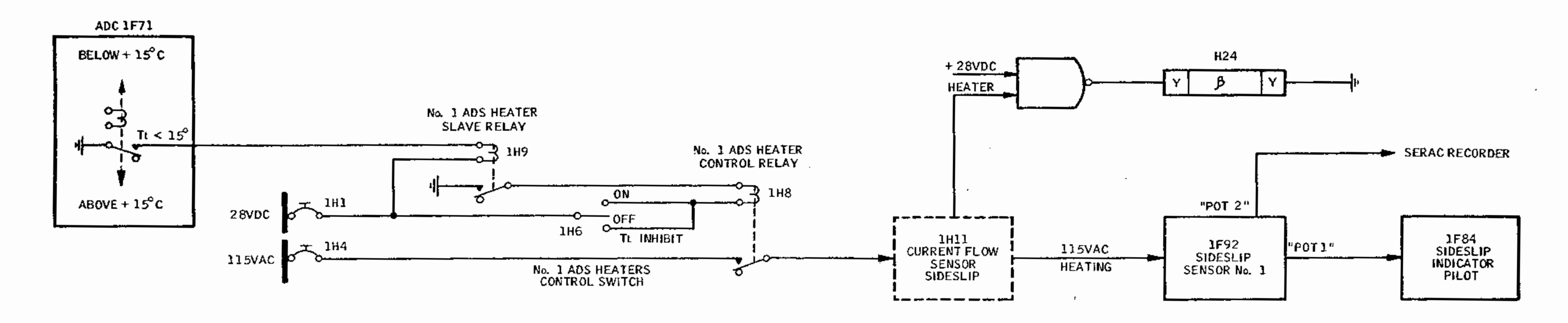
Sideslip sensor (1F92) controlled by its vane sends information as follows :

- POT 1 information to Captain sideslip indicator (1F84). The indicator pointer indicates angles within a range of 15° left to 15° right.
- POT 2 information to SERAC recorder, recopying parameter value

(2) System 2

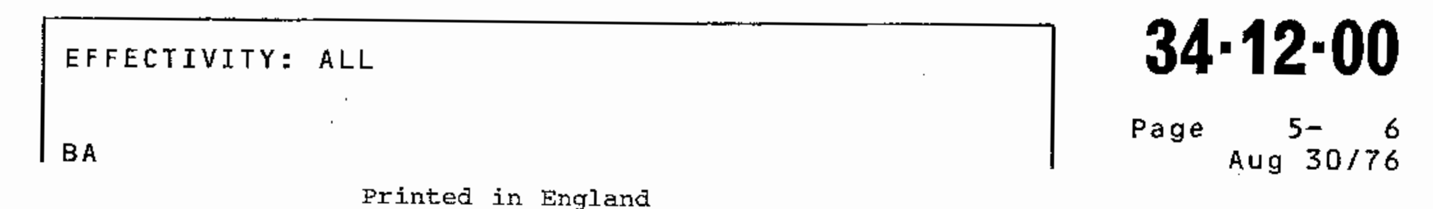
Sideslip sensor (2F92) controlled by its vane sends information as follows :

- POT 1 information to First Officer sideslip indicator (2F84). The indicator pointer indicates angles within a range of 15° left to 15° right
- POT 2 information to air intake system sensor units. As the potentiometer is no longer supplied with a reference voltage this circuit is not used although



R

Sideslip : System Operation Block Diagram
Figure 004



R the interconnection wiring still exists.

B. Heating

R NOTE : As the two systems are similar, only system 1
R heating will be described. For system 2 replace
R 1 identifiers by 2.

Circuit-breakers 1H1 and 1H4 are reset. If the ADC (1F71) detects total temperature of Tt < 15°, relay (1H9) is energized.
It places a ground on relay coil (1H8), which will be energized if switch (1H6) is in the ON or Tt INHIBIT positions. Relay (1H8) applies 115 VAC, to the sideslip sensor (1F92) via CURRENT FLOW SENSOR SIDESLIP (1H11) which causes indicator light (B) on panel H24, zone 4-211, to extinguish.

SIDESLIP - TROUBLE SHOOTING

CAUTION : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, TROUBLE SHOOTING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of trouble shooting procedures (Ref. paragraph 3) and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK. All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available unless otherwise stated. If the fault is not rectified check the wiring in accordance with the wiring diagram manual (Ref. table at end of topic). The two sideslip systems are similar and trouble shooting procedures are described for system 1, for system 2 trouble shooting refer to electrical identifiers and items in parentheses. Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. table 101).
The table provides information, including component location, required for rectification.

2. Prepare

A. Equipment and Materials.

DESCRIPTION	PART NO.
Setting Tool - Yaw Vane	E925041001
Electrical Ground Power Unit	
Access Platform, Height of Access 3.468m (11ft. 4in.).	

B. Preliminaries

(1) Position access platform under angle of sideslip sensor 1F92, between frames 13 and 14 (2F92, frames 17 and 18) in zone 123.

(2) Remove protective cover from angle of sideslip sensor if necessary (item E935040000).

(3) Fit yaw vane (angle of sideslip sensor) setting tool (Tool E925041001).

(4) On ADC control panel, centre console 9-211, make certain that ADC1 (ADC2 ON/OFF switch 1F94 (2F94) is in OFF position.
Place test selector switch 1F102 (2F102) in NORM position.

(5) Connect electrical ground power unit and energize the aircraft electrical network)Ref. 24-41-00, Servicing).

(6) Switch on electronics rack ventilation system (Ref. 21-21-00).

(7) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC 1 28V SUP	1-213	1F 74	P12
1ST PLT ADC INST SUP	2-213	1F 75	B 3
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC 2 28V SUP	5-213	2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
NAV INST BUS 13XS		X 345	G 4

(8) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS 1 PROBE HTRS CONT	1-213	1H 1	K 8
ADS 1 S/SLIP PROBE HTR SUP	2-213	1H 4	F23
ADS 2 PROBE THRS CONT	3-213	2H 1	A11
ADS 2 S/SLIP PROBE HTR SUP	13-216	2H 4	D10

3. Trouble shooting

```
*****************************************************
* Place ADC [1], ([2]) ON/OFF switch in ON position.*
* Check on sideslip indicator [3], ([4]) that flap  *
* has disappeared. IF                               *
*****************************************************
   ||    |        ---------------------------------------------------
   OK    |-NOT OK--| Flag does not disappear.                        |
   ||              | Ref, Chart 101                                  |
   ||             ---------------------------------------------------
*****************************************************
* Position sideslip sensor vane [1], ([8]) facing   *
* graduation marks on tool at following points and  *
* check readings on sideslip indicator [3], ([4]).  *
* -20° read -10° ±0.5°                              *
*  0°  read 0° ±0.2°                                *
* +5°  read +2.5° ±0.3°                             *
* +20° read +10° ±0.5° IF                           *
*****************************************************
   ||    |        ---------------------------------------------------
   OK    |-NOT OK--| Incorrect reading on sideslip indicator.        |
   ||              | Ref. Chart 102                                  |
   ||             ---------------------------------------------------
*****************************************************
* Sideslip system is operational.                   *
*****************************************************
```

```
***************************************
* FLAG DOES NOT DISAPPEAR             *
***************************************

*********************************************************************
* Carry out RESET by pressing ADC1 [5], (ADC2 [6]) indicator light.*
* Flags disappear on ADC1 (ADC2) indicators on Captain (First      *
* officer) instrument panels.                                       *
*********************************************************************
      |                                           |
     YES                                          NO
      |                                           |
-------------------------------------    -------------------------------
| Replace sideslip indicator [3],   |    | Ref. Normal air data        |
| ([4]). Flag disappears.           |    | instrumentation.            |
-------------------------------------    | (Ref. 34-11-00, Trouble     |
      |                                  | Shooting).                  |
      NO                                 -------------------------------
      |
-------------------------------------
| Replace sideslip sensor [7],      |
| ([8]).                            |
-------------------------------------
```

R (revision mark beside the line "Flags disappear on ADC1 (ADC2) indicators...")

Chart 101

```
*************************************
* INCORRECT READING ON SIDESLIP     *
* INDICATOR.                        *
*************************************

*******************************************************************
* Replace sideslip sensor [7], ([8]). Repeat checks.              *
*******************************************************************
                          |
                          NO
                          |
-------------------------------------------------------------------
| Replace sideslip indicator [3], ([4]).                          |
-------------------------------------------------------------------
```

Chart 102

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] ON/OFF switch		9-211	1F94	ADC control panel	34-11-29	34-10-01
[2] ON/OFF switch		9-211	2F94	ADC control panel	34-11-29	34-10-01
[3] Sideslip indicator		2-211	1F84	Captain instrument panel	34-00-00 R/I	34-12-01
[4] Sideslip indicator		2-212	2F84	First Officer instrument panel	34-00-00 R/I	34-12-01
[5] ADC1 indicator light		9-211	1F95	ADC control panel	34-11-29	34-11-05
[6] ADC2 indicator light		9-211	2F95	ADC control panel	34-11-29	34-11-05
[7] Angle of sideslip sensor		123	1F92	Between FR13 and FR14	34-12-11 R/I	34-12-01
[8] Angle of sideslip sensor		123	2F92	Between FR17 and FR18	34-12-11 R/I	34-12-01

R Component Identification
Table 101

SIDE SLIP - MAINTENANCE PRACTICES

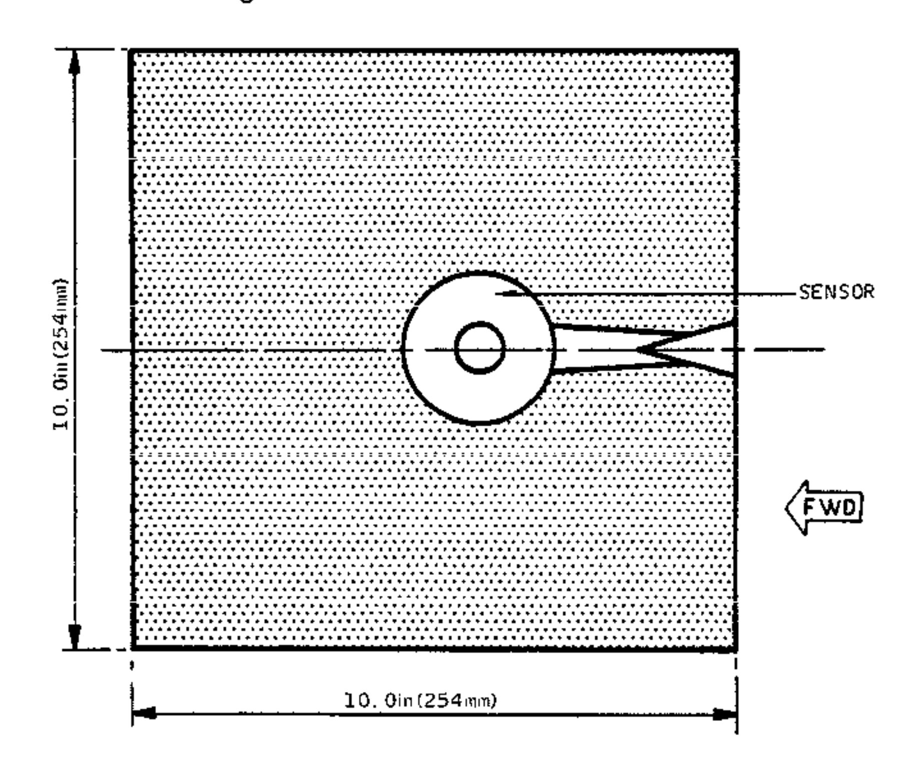
1. General

The areas around the fuselage mounted side slip sensors are designated as special areas. Any damage or irregularities in these special areas will affect readings of Mach Number, airspeed and altitude, and will also affect the operation of the intake control system.

Damage to these special areas must be reported, recorded and the appropriate rectification action taken.

2. Sensors - Area Damage Limitations
(Ref. Fig. 201)

The special areas for the pitot heads, and sensors installation are shown in Figure.



Sensor - Special areas
Figure 201

Scores and scratches of a maximum depth of 0.02 ins (0.5 mm) are allowed, provided that all protruding burrs are removed.

Blending out is permitted in these areas providing the restrictions and procedures as listed in the structure repair manual 53-30-00 are complied with.

SIDESLIP = ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Cover - Yaw Vane	E935040000
Electrical Ground Power Unit	
Access Platform, Access Height 3.468 m (11 ft. 4 in.)	

R B NOTE : The sideslip sensors are electrically heated for de-icing
R B purposes. If they are switched on when the aircraft is
R B on the ground, they get HOT. Before any maintenance
R B work is carried out in the immediate vicinity of these
R B vanes, it must be checked that the relevant heating
R B supply is switched off, and a "DO NOT OPERATE" sign
R B is placed on the relevant heater control switch.
R B Ground operation of the vane heaters should be kept to
R B a minimum. Heaters should only be operated on the
R B ground, during Maintenance, when checking the function
R B of the current sense relays, and correct operation of
R B the heating circuits.

B. Prepare

(1) Position access platform under angle of sideslip sensor No.1 (1F92), between frames 13 and 14 (zone 123).

(2) Remove protective cover (E935040000) from angle of sideslip sensor No.1 if necessary.

(3) On centre console 9-211, make certain that on ADC control panel :

(a) ADC1 and ADC2 ON-OFF switches are placed in OFF position.

(b) TEST 1-2, MON, NORM, selector switches are in NORM position.

(4) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servi-

cing).

(5) Switch on electronics rack ventilation system (Ref. 21-21-00).

(6) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC 1 28 V SUP	1-213	1F 74	P12
1ST PLT ADC INST SUP	2-213	1F 75	B 3
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC 2 28 V SUP	5-213	2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
NAV INST BUS 13XS		X 345	G 4

(7) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS1 PROBE HTRS CONT	1-213	1H 1	K 8
ADS1 S/SLIP PROBE HTR SUP	2-213	1H 4	F23
ADS2 PROBE HTRS CONT	3-213	2H 1	A11
ADS2 S/SLIP PROBE HTR SUP	13-216	2H 4	D10

C. Tests

(1) Check of sideslip system 1 circuit

(a) On centre console 9-211, on ADC control panel, place ADC1 ON-OFF switch in ON position :

(a1) Check on Captain instrument panel 2-211 that warning flags on Captain sideslip indicator (1F84) have disappeared.

(b) Position sensor vane to left and check on Captain sideslip indicator that pointer has deflected to

right.

(c) Position sensor vane along aircraft centre line and check on Captain sideslip indicator that pointer is in zero position.

(d) Position sensor vane to right and check on Captain sideslip indicator that pointer has deflected to left.

(e) Position sensor vane along aircraft centre line.

(f) On panel 9-211, on ADC control panel, place AD1 ON-OFF switch in OFF position :

(f1) Check on Captain sideslip indicator (1F84) that warning flags are visible.

(g) Place protective cover (E935040000) on angle of sideslip sensor No.1.

(2) Check of sideslip system 2 circuit

(a) Position access platform under angle of sideslip sensor No.2 (2F92) between frames 17 and 18 (Zone 123).

(b) Remove protective cover (E935040000) from angle of sideslip sensor No.2 if necessary.

(c) On centre console 9-211, on ADC control panel, place ADC2 ON-OFF switch in ON position :

(c1) Check on First Officer instrument panel (2-212) that warning flags on First Officer sideslip indicator (2F84) have disappeared.

(d) Position sensor vane to left and check on First Officer sideslip indicator that pointer has deflected to right.

(e) Position sensor vane along aircraft centre line and check on First Officer sideslip indicator that pointer is in zero position.

(f) Position sensor vane to right and check on First Officer sideslip indicator that pointer has deflected to left.

(g) Position sensor vane along aircraft centre line.

(h) On panel 9-211, on ADC control panel, place ADC2 ON-OFF switch in OFF position :

(h1) Check on First Officer sideslip indicator (2F84) that warning flags are visible.

(i) Place protective cover (E935040000) on angle of sideslip sensor No.2.

(j) Remove access platform from working area.

D. Close-Up

(1) Reset the circuit breakers previously tripped in paragraph 1-B-(7).

(2) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Page 301, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Cover - Yaw Vane	E935040000
Setting Tool - Yaw Vane	E925041001
Electrical Ground Power Unit	
Access Platform, Access Height 3.468 m (11 ft. 4 in.)	

B. Prepare

(1) Place access platform under angle of sideslip sensor No.1 (1F92) between frames 13 and 14 (Zone 123).

(2) Remove protective cover (E935040000) from angle of sideslip sensor if necessary.

(3) Fit vane setting tool (Ref. E925041001) on sensor No.1 (1F92).

(4) On centre console 9-211, make certain that on ADC control panel :

(a) ADC1 and ADC2 ON-OFF switches are in OFF position.

(b) TEST 1-2, MON, NORM, COMP selector switches are in NORM position.

(5) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing)

(6) Switch on electronics rack ventilation system (Ref. 21-21-00).

(7) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC 1 28 V SUP	1-213	1F 74	P12

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
1ST PLT ADC INST SUP	2-213	1F 75	B 3
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC 2 28 V SUP	5-213	2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
NAV INST BUS 13XS		X 345	G 4

(8) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS1 PROBE HTRS CONT	1-213	1H 1	K 8
ADS1 S/SLIP PROBE HTR SUP	2-213	1H 4	F23
ADS2 PROBE HTRS CONT	3-213	2H 1	A11
ADS2 S/SLIP PROBE HTR SUP	13-216	2H 4	D10

C. Tests

(1) Check of sideslip system 1 circuit.

(a) On centre console 9-211, on ADC control panel, place ADC1 ON-OFF switch in ON position :

(a1) Check on Captain instrument panel 2-211 that warning flags on Captain sideslip indicator (1F84) have disappeared.

(b) Position sensor vane opposite setting tool graduations then check on sideslip indicator that readings correspond with those given in table below.

NOTE : Negative sideslip corresponds on the indicator with a pointer deflection to right, but requires that sensor vane be turned to left.

SETTING IN DEGREES ON SENSOR	READING IN DEGREES ON INDICATOR
- 20°	- 10° ± 0.5
0°	0° ± 0.2
+ 5°	+ 2.5° ± 0.3
+ 20°	+ 10° ± 0.5

(c) Return sensor vane to 0° position.

(d) On panel 9-211, on ADC control panel, place ADC1 ON-OFF switch in OFF position :

(d1) Check on Captain sideslip indicator (1F84) that warning flags are visible.

(e) Remove vane setting tool (Ref. E925041000) from sensor No.1 (1F92).

(f) Place protective cover on angle of sideslip sensor No.1 (E935040000).

(2) Check of sideslip system No.2 circuit

(a) Position access platform under angle of sideslip sensor No.2 (2F92) between frames 17 and 18 (Zone 123).

(b) Remove protective cover (E935040000) from angle of sideslip sensor No.2 if necessary.

(c) Fit vane setting tool (Ref. E925041001) on sensor No.2.

(d) On centre console 9-211, on ADC control panel, place ADC2 ON-OFF switch in ON position :

(d1) Check on First Officer instrument panel (2-212) that warning flags on First Officer sideslip indicator (2F84) have disappeared.

(e) Position sensor vane opposite setting tool graduations then check on sideslip indicator that readings correspond with those given in table below :

NOTE : Negative sideslip corresponds on the indicator with a pointer deflection to right, but requires that sensor vane be turned to left.

SETTING IN DEGREES ON SENSOR	READING IN DEGREES ON INDICATOR
- 20°	- 10° ± 0.5
0°	0° ± 0.2
+ 5°	+ 2.5° ± 0.3
+ 20°	+ 10° ± 0.5

(f) Return sensor vane to 0° position.

(g) On panel 9-211, on ADC control panel, place ADC2 ON-OFF switch in OFF position.

(g1) Check on First Officer sideslip indicator (2F84) that warning flags are visible.

D. Close-Up

(1) Remove vane setting tool (Ref. E925041000) from sensor No.2 (2F92).

(2) Place protective cover on angle of sideslip sensor No.2 (E935040000).

(3) Remove access platform from working area.

(4) Reset the circuit breakers previously tripped in paragraph 2-B-(8).

(5) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(6) Switch off electronics rack ventilation system (Ref. 21-21-00).

(7) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

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3. System Test

Identical with functional test, refer to paragraph 2.

ANGLE OF SIDESLIP SENSOR - REMOVAL/INSTALLATION

R 1. General

R Removal for replacement or check. The two sensors are iden-
R tical, sideslip system No.1 sensor (1F92) is located between
R frames 13 and 14, sideslip system No.2 sensor (2F92) is loca-
R ted between frames 17 and 18 in zones 123 and 124.

R B NOTE : The angle of sideslip sensors are electrically heated
R B for de-icing porposes. If they are switched on when
R B the aircraft is on the ground, they get HOT. Before
R B any Maintenance work is carried out in the immediate
R B vicinity of these vanes, it must be checked that the
R B relevant heating supply is switched off, and a "DO NOT"
R B OPERATE" sign is placed on the relevant heater control
R B switch. Ground operation of the vane heaters should be
R B kept to a minimum. Heaters should only be operated on
R B the ground during Maintenance, when checking the funct-
R B tion of the current sense relays, and correct operation
R B of the heating circuits.

2. Sideslip Sensor

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Access Platform, Access Height 3.468 m (11 ft. 4 in.)	
Blanking Plugs/Caps	
Cover - Yaw Vane	E935040000
Common Grease (Ref. 20-30-00, No.051)	
Lockwire, Diameter 0.45 mm (0.018 in.) Z3CNT18 Annealed	
Lockwire, Diameter 1 mm (0.040 in.) Z3CNT18 Annealed	
Special Material (Ref. 20-30-00, No.128)	

B. Prepare

(1) For operation on sensor (1F 92)

(a) On ADC control panel on centre console 9-211, make certain that ADC1 ON-OFF switch is placed in OFF position, and that TEST selector switch is placed in NORM position.

(b) On panel 4-211, make certain that ADS AND ENG PROBE HEATERS (It INHIB-OFF-ON ADC1) switch is in OFF position.

(c) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS 1 PROBE HTRS CONT	1-213	1H 1	K 8
ADC 1 28 V SUP		1F 74	P12
ADC 1 115 V SUP	2-213	1F 73	F 3
ADS 1 S/SLIP PROBE HTR SUP		1H 4	F23

(2) For operation on sensor (2F 92)

(a) On ADC control panel located on centre console 9-211, make certain that ADC 2 ON-OFF switch is placed in OFF position, and that TEST selector switch is placed in NORM position.

(b) On panel 4-211, make certain that ADS AND ENG PROBE HEATERS (It INHIB-OFF-ON ADC 2) switch is in OFF position.

(c) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADS 2 PROBE HTRS CONT	3-213	2H 1	A11
ADC 2 28 V SUP	5-213	2F 74	F12
ADS 2 S/SLIP PROBE HTR	13-216	2H 4	D10

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SUP			
ADC 2 115 V SUP	2F	73	F15

(3) Position access platform below sensor to be removed.

(4) Remove protective covers (Ref. E935040000) from angle of sideslip sensors if necessary.

WARNING : CARE MUST BE TAKEN ON REMOVAL OF ANGLE OF ATTACK OR SIDESLIP SENSOR UNITS PRIOR TO FITTING REPLACEMENTS THAT ONLY THE FOUR WIRE-LOCKED BOLTS ARE RELEASED. DISTURBANCE OF THE NUTS OF THE OTHER SIX BOLTS WILL INVALIDATE SENSOR UNIT ALIGNMENT.

C. Remove (Ref. Fig. 401)

(1) Remove the fourteen philips screws (9) from mounting plate (10) supporting sensor assembly (4), on aircraft structure (1), while holding plate in position.

CAUTION : SENSOR VANE MUST NOT BE USED TO SUPPORT ASSEMBLY DURING THIS OPERATION.

(2) Slowly disengage assembly from its housing (2), disconnect plug (13) from sensor connector (12), fit blanking caps.

(3) Cut and remove lockwire, remove the four screws (3) securing sensor on its inner plate.

(4) Disengage sensor assembly (4) from its inner plate (8)

CAUTION : TAKE CARE TO AVOID DAMAGE TO SENSOR VANE DURING THIS OPERATION.

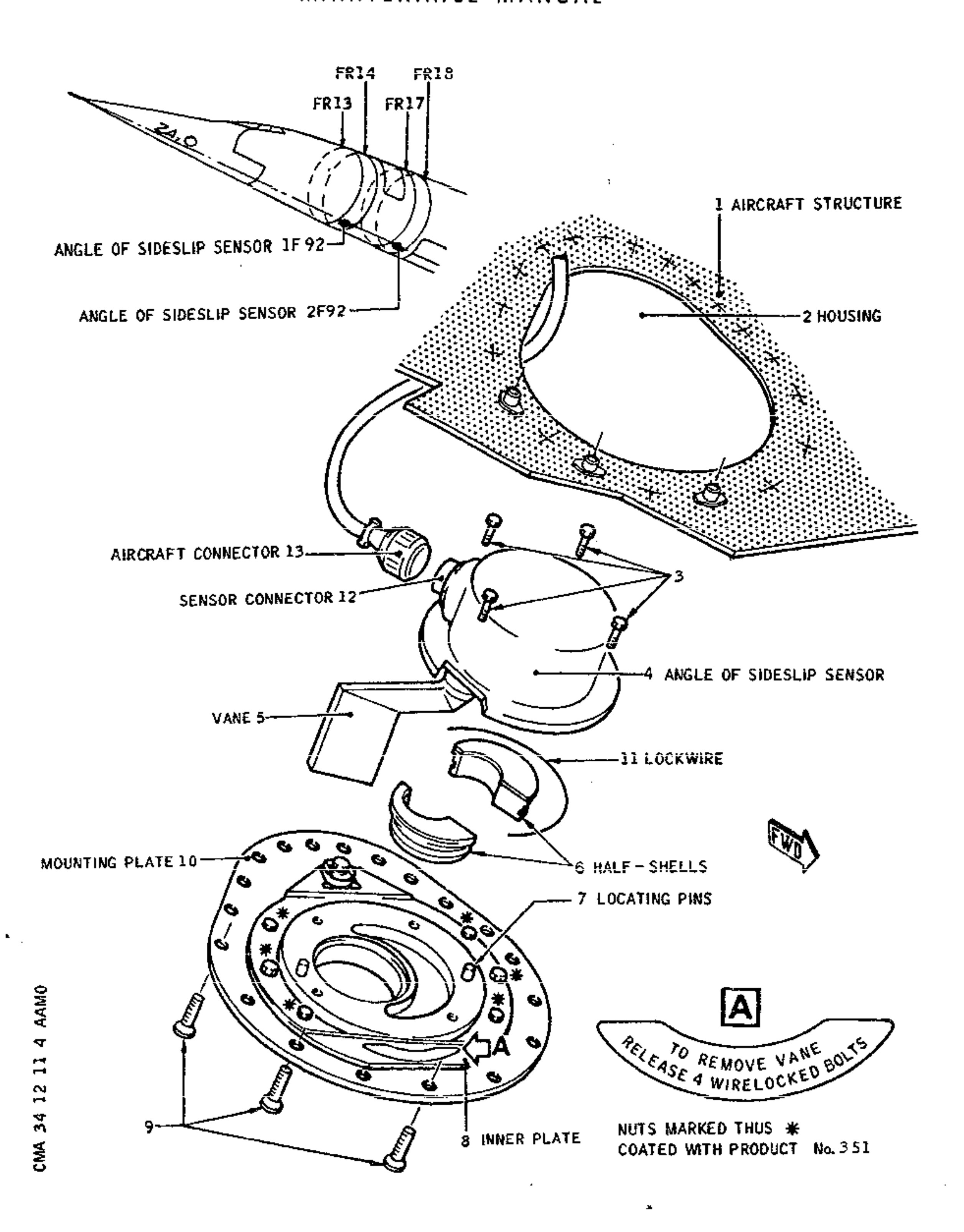
(5) Remove lockwire (11) securing bushing half-shells (6), retain half-shells.

D. Preparation of Replacement Component

(1) On aircraft make certain that sensor housing (2) is clean and that connector (13) is in good condition.

(2) Make certain that sensor inner plate (8) mounting

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R Angle of Sideslip Sensor: Removal/Installation
Figure 401

plate (10) and bushing half-shells (6) are clean and that the label TO REMOVE VANE RELEASE 4 WIRELOCKED BOLTS is in position.

(3) Make certain :

(a) That sensor connector (12) has no trace of corrosion and that pins are undamaged.

(b) Of good external condition of angle of sideslip sensor, that vane shows no sign of burrs or cracks.

E Install
(Ref. Fig. 401)

(1) Coat internal surfaces of half-shells (6) with product No.051, fit half-shells around vane (5) shaft using lockwire (11) diameter 0.45 mm.

(2) Coat with product No.051 angle of slipside sensor base locating pins (7) and screws (3).

(3) Position sensor assembly facing locating pins (7) on inner plate (8), secure to plate (10) taking care to avoid damage to vane during this operation.

R (4) Coat six attachment screws (*) with product No.351.

(5) Install four securing screws (3), tighten and wirelock in pairs using lockwire diameter 1 mm.

(6) Remove blanking caps from electrical connectors.

(7) Position sensor assembly mounting plate (10) facing housing (2), connect aircraft plug (13) to sensor connector (12).

(8) Install mounting plate on aircraft structure, install and tighten the 14 philips screws (9).

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraphs 2. B. (1) (c) or 2. B. (2) (c).

(2) Carry out a sideslip circuit test (Ref. 34-12-00 Adjustment/Test).

(3) Carry out an angle of sideslip sensor heating test

(Ref. 30-31-00, Adjustment/Test).

G. Close-Up

(1) Install protective covers (Ref. E935040000).

(2) Remove access platform from working area.

R **ON A/C 001-007,

ANGLE OF SIDESLIP SENSOR - INSPECTION/CHECK

1. General

This is an in situ check to monitor the condition of the bearings, damping mechanism and potentiometer drive.

A. Ensure YAW (angle of sideslip) system is not in use and that the vane heater is OFF.

B. Check vane statically, there should be no side or end play on the bearings. There should be no evidence of misalignment or damage to the vane.

C. Move vane slowly between the limits of its travel. Movement should be of uniform smoothness throughout its range. Repeat in reverse direction. There should be no perceptible backlash in the drive.

D. With vane in normal position measure the force required to rotate it. Force applied at trailing edge of vane should be less than 12 grammes.

SIDESLIP INDICATOR - REMOVAL/INSTALLATION

1. General

The indicators are mounted on the Captain (2-211) and First Officer (2-212) main instrument panels.
Because of insufficient wiring length, these indicators cannot be removed by direct extraction from the front.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On Captain (12-211) and First Officer (5-212) instrument panels, make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) On centre console 9-211, ADC control panel, make certain that :

(a) ADC1 and ADC2 switches are in OFF position.

(b) Test selector switches are in NORM position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC 1 28 V SUP	1-213	1F 74	P12
1ST PLT ADC INST SUP	2-213	1F 75	B 3
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC 2 28 V SUP	5-213	2F 74	F12
LH DASH INST LTS SUP	13-215	L 372	A12
2ND PLT ADC INST SUP	13-216	2F 75	A14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 4

C. Remove (Ref. Fig. 401)

(1) Loosen and remove the four indicator (7) mounting screws (6).

(2) Carefully release indicator from its seating (1). Support indicator.

(3) Under instrument panel, disconnect the two indicator connectors (3).

(4) Withdraw indicator (7).

(5) Cap connectors (3) and (4).

D. Preparation of Replacement Component

(1) Make certain that indicator seating is clean and that connectors and aircraft wiring are in correct condition.

(2) Visually check that indicator is in correct external condition, that its connectors are undamaged and have no traces of corrosion.

E. Install

(1) Remove blanking caps from connectors (3) and (4).

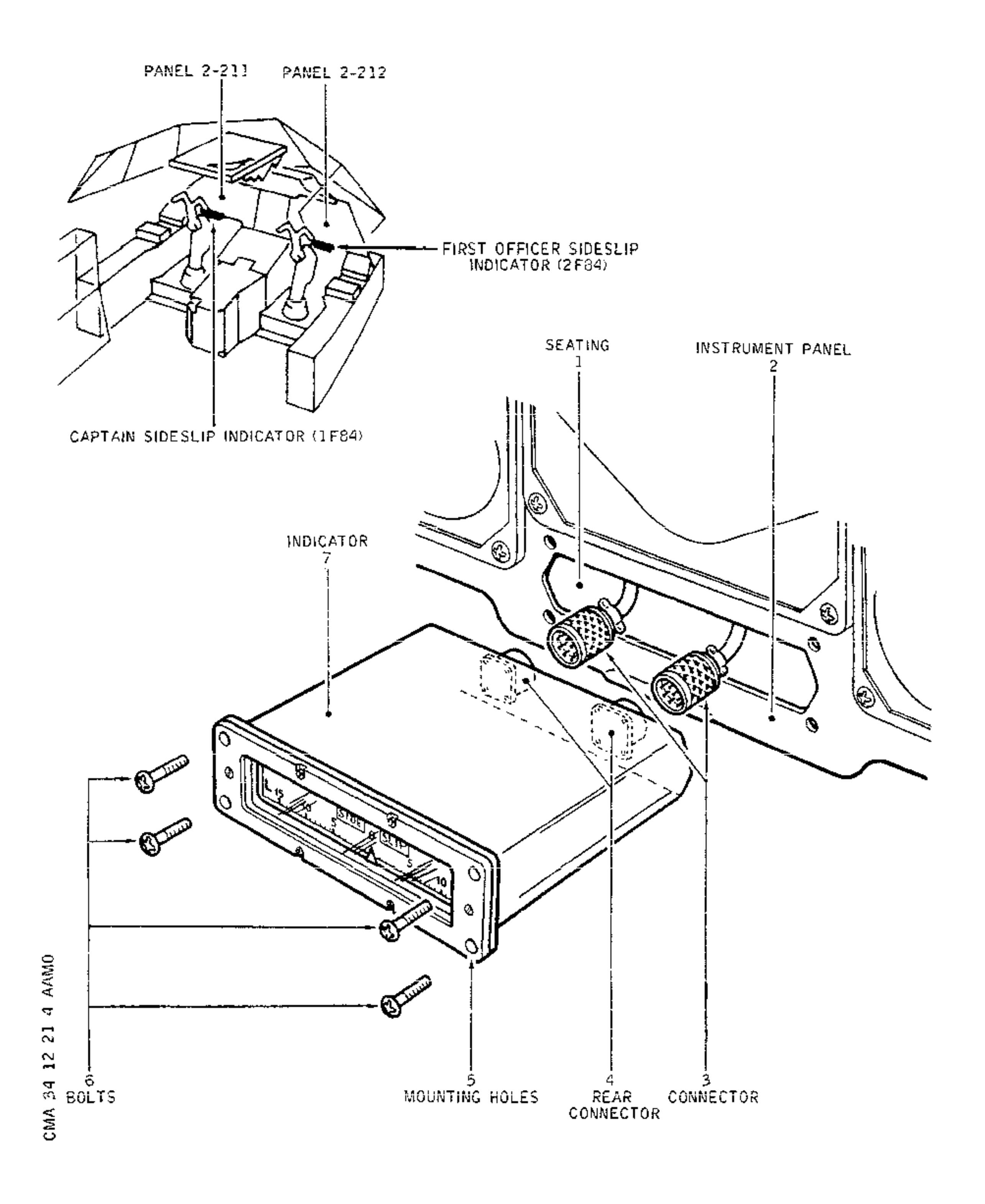
(2) Position indicator (7) facing its seating (1) and carefully install.

(3) Under instrument panel (2) connect aircraft connectors (3) to indicator rear connectors (4).

(4) Push indicator (7) fully against instrument panel

(5) Position 4 mounting screws (6) in holes (5) on indicator. Tighten screws.

F. Tests



Removal/Installation of a Sideslip Indicator
Figure 401

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2. B. (3).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) Adjust LH and RH DASH INSTRUMENTS potentiometer on panels 12-211 and 5-212 so as to obtain correct illumination of indicator faces.

(5) On centre console 9-211, ADC control panel :

(a) Make certain that test selector switches are in NORM position.

(b) Place ADC1 (ADC2) switches in ON position :
- After approximately thirty seconds press and release ADC1 (ADC2) amber warning light which remains extinguished.
- Check on Captain (First Officer) sideslip indicator that warning flag has disappeared.

(6) Zone 123, move sideslip sensor vane of circuit under test and check on Captain (First Officer) sideslip indicator that pointer is displaced.

(7) Realign sideslip sensor vane with aircraft centre line

(8) On centre console 9-211, ADC control panel :

(a) Place ADC1 (ADC2) switch in OFF position :
- On Captain (First Officer) sideslip indicators warning flags are visible.

G. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(3) Trip the following circuit breakers :

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R	FLT CONT & NAV BUS 14XS	2-213	X355	H 2
R	NAV INST BUS 13XS	13-216	X345	G 4

STANDBY AIR DATA INSTRUMENTATION - DESCRIPTION AND OPERATION

1. General

A nose probe which produces total and static pressure information supplies instruments operating in standby mode on the Captain and First Officer instrument panels. Total and static pressure information is applied to a sensor unit.

R B(Ref. Fig. 001)

R 2. Description

R A. Standby Air Data Instrumentation System Component

R R (1) Nose probe (H125) (Ref. 34-13-13, Description and Operation).

R B (2) Standby Altimeter removed per CM 42517 iss.C.

R (3) One airspeed/mach indicator (F49).

R (4) Two airspeed indicators (1F81 and 2F81).

R (5) Two altimeters (1F79 and 2F79).

R B. External Circuit

R (1) One pressure sensor unit transmitter (2K1801A).

3. Indicator-Airspeed/Mach

A. General

The instrument operates from static and total pressure information. It indicates calibrated airspeed, mach number (above 250 Kts) and VMO speed.
The airspeed/mach indicator is mounted on the Captain instrument panel.

(1) Description (Ref. Fig. 002)

The instrument face consists of :

- a fixed dial graduated from 100 to 650 Kts
- a moving dial graduated from 0.4 to 2.5 mach
- a fixed marker positioned at mach 2.02
- a checkered VMO pointer (black - arc-yellow)
- a white speed indicator pointer. Above 250 Kts, the mach number corresponding to the speed is read simultaneously on the moving scale inset into the fixed

INTENTIONALLY BLANK

FR1
FR1A
FR3
FR7

ALTIMETER
2F79

AIRSPEED
INDICATOR
2F81

FIRST OFFICER
INSTRUMENT PANEL
2-212

Ps

DRAIN VALVE

S01
P01

NOSE PROBE
H125

PS
PT

DRAIN VALVE

PS

ALTIMETER
1F79

AIRSPEED
INDICATOR
1F81

AIRSPEED /
MACHMETER
INDICATOR F49

CAPTAIN
INSTRUMENT
PANEL
2-211

PT

PRESSURE SENSOR
UNIT TRANSMITTER
10-215

PRESSURE CAP
6-215

ELECTRONICS
RACK

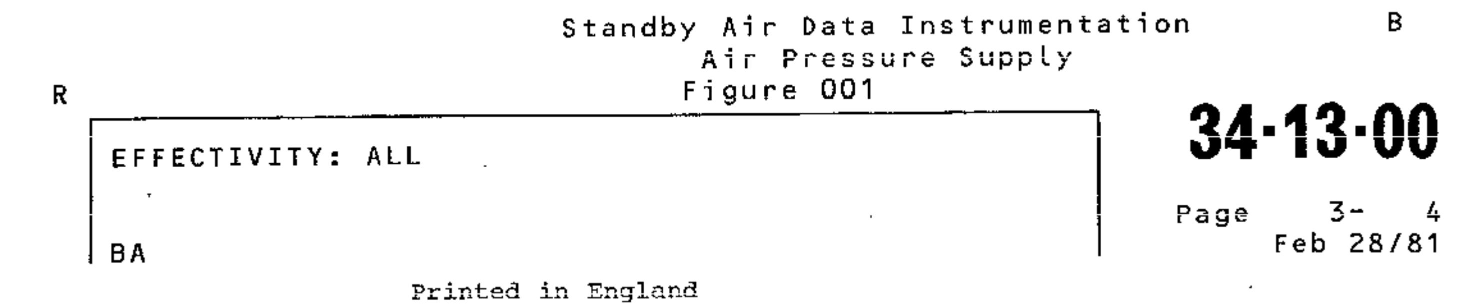
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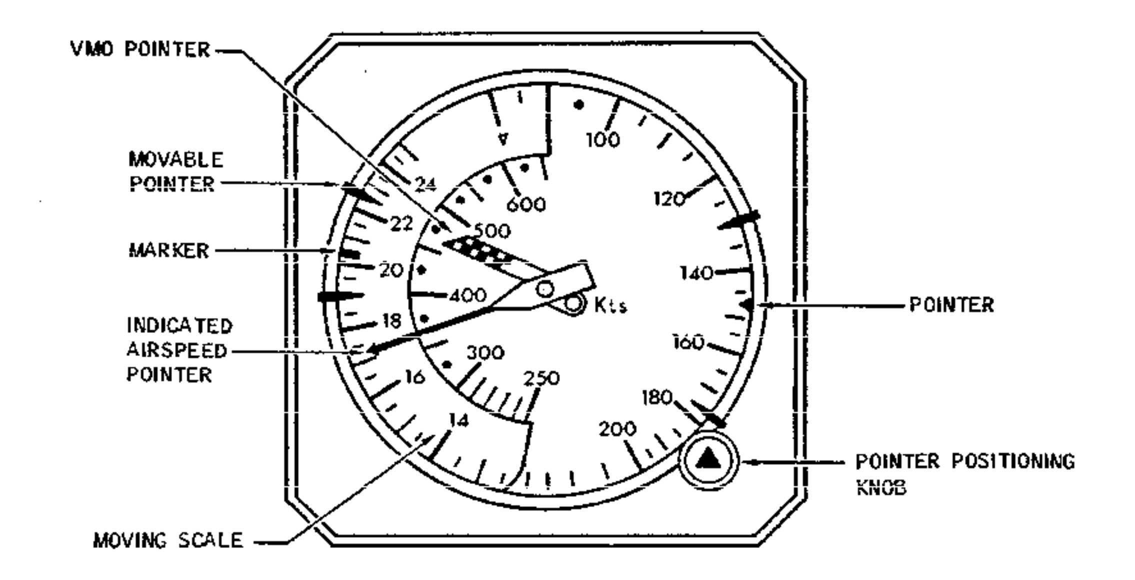
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Standby Air Data Instrumentation
Air Pressure Supply
Figure 001

B

R





Airspeed/Mach Indicator : Front View
Figure 002

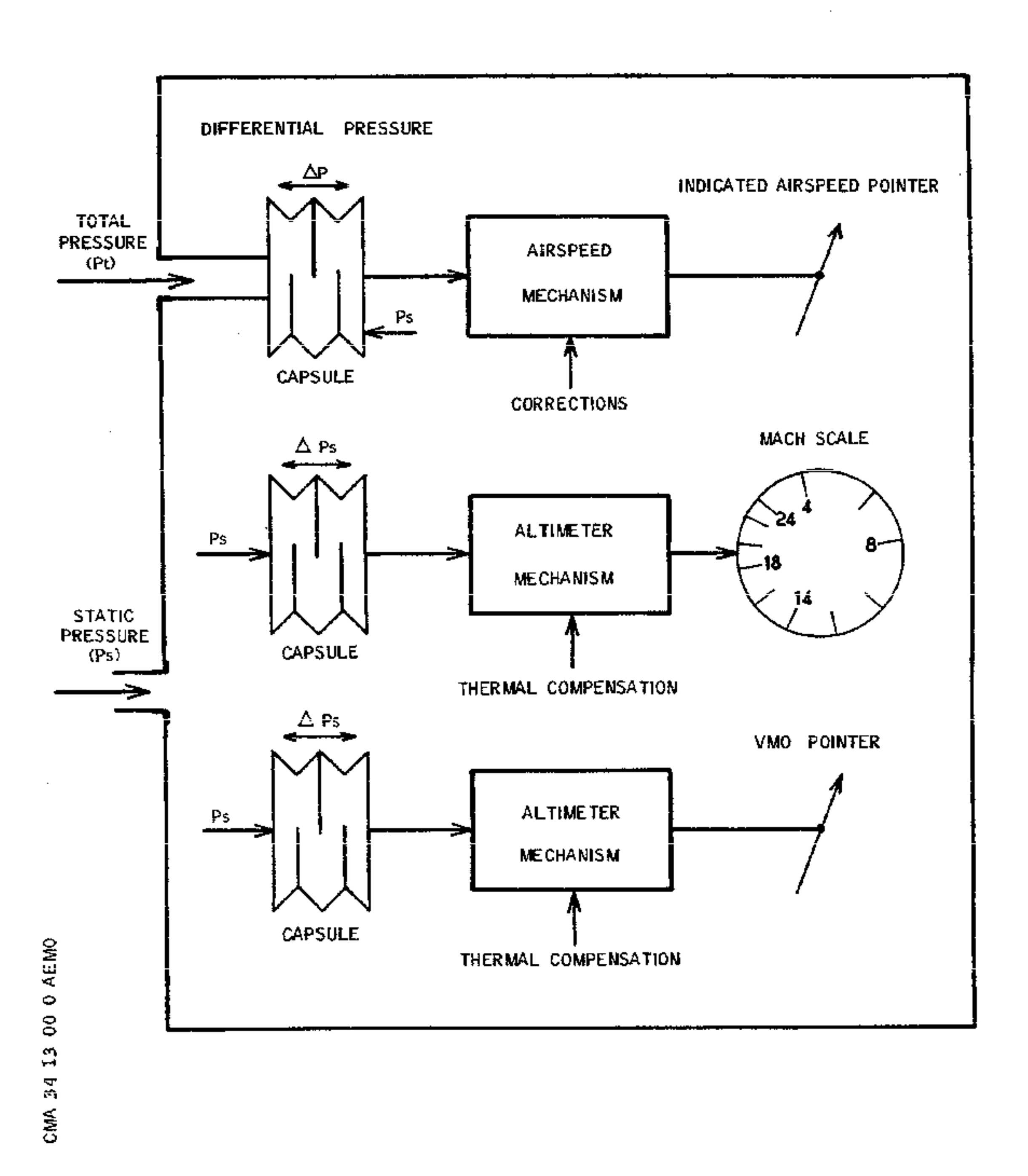
scale, by the same pointer
- a movable pointer enabling reading of a selected speed below 250 Kts
- a pointer positioning button
- four movable pointers in different colors. They slide around the periphery of the scale, and are manually adjustable.

(2) Operation (Ref. Fig. 003)

The instrument consists of three independent instruments contained in a casing. The mechanisms connect

- an airspeed capsule to the main pointer
- an altitude capsule to the mach scale
- an altitude capsule to the checkered VMO pointer. The case in connected to the total and static pressure intakes. The airspeed capsule receives total pressure directly.

(a) Airspeed mechanism



Airspeed/Mach Indicator : Block Diagram
Figure 003

Differential pressure variations cause deformation of the capsule. The resulting linear displacement is translated into rotational movement by a mechanical airspeed pointer control system. Corrections are made in the mechanism which enable capsule deflection to be indicated as airspeed in Kt.

(b) Altitude mechanism (mach drive)

Static pressure variations cause deformation of the capsule. Linear displacement is translated into rotational movement as a function of altitude by a mechanical system of mach scale control. The mechanism includes a thermal compensation device.

(c) Altitude mechanism (VMO drive)

Operation is identical with that of the preceding mechanism, and drives the VMO pointer.

4. Indicator - Airspeed

A. General

The airspeed indicator has an incorporated standby facility, and gives speed indications according to mode of operation (Normal or Standby) selected by means of a selector knob on the front of the instrument. In STBY mode the indicator uses a total and static pressure input, in NORMAL mode an electrical input signal comes from the air data computer.

(1) Normal mode

(Ref. description and operation, 34-11-10).

(2) Standby mode

(a) Description (Ref. Fig. 004)

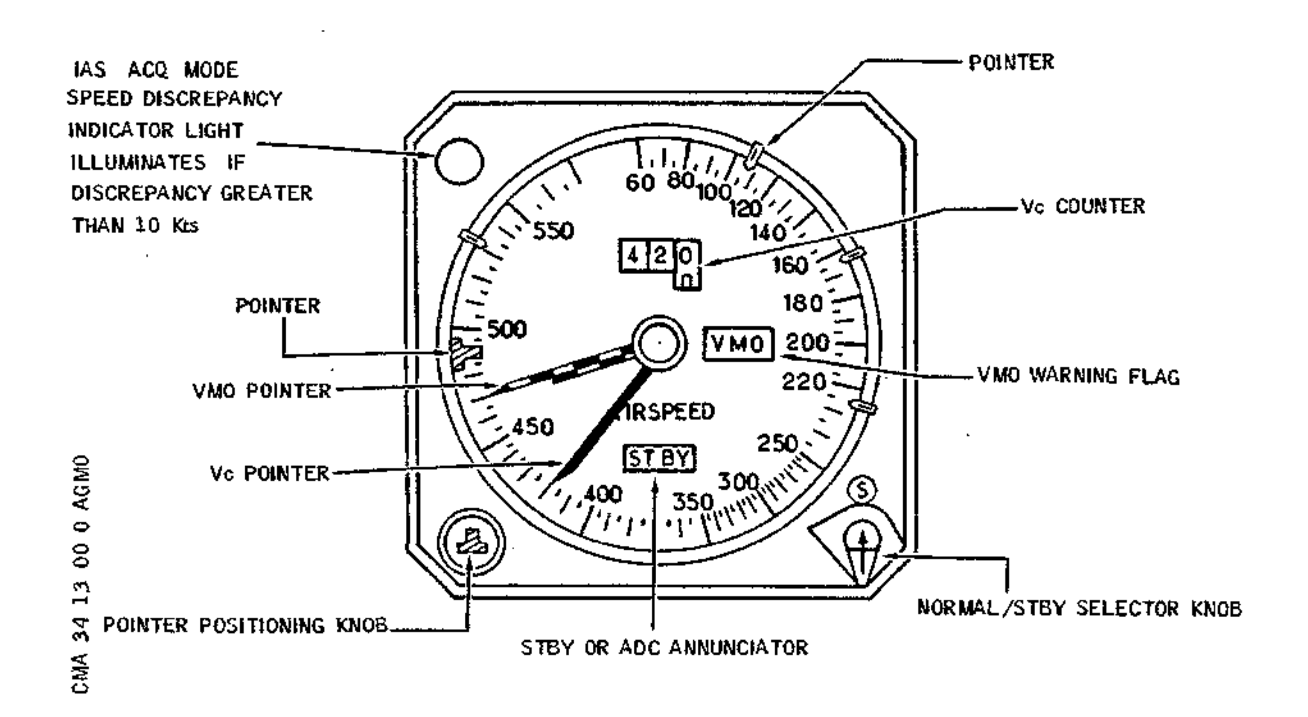
(Refer to paragraph 2, 34-11-10).

(b) Operation (Ref. Fig. 005)

(b1) Transducer

An aneroid capsule receives total and static pressure information and its movement is detected by an inductive pick off.

(b2) Servo-control



Airspeed Indicator : Front View
Figure 004

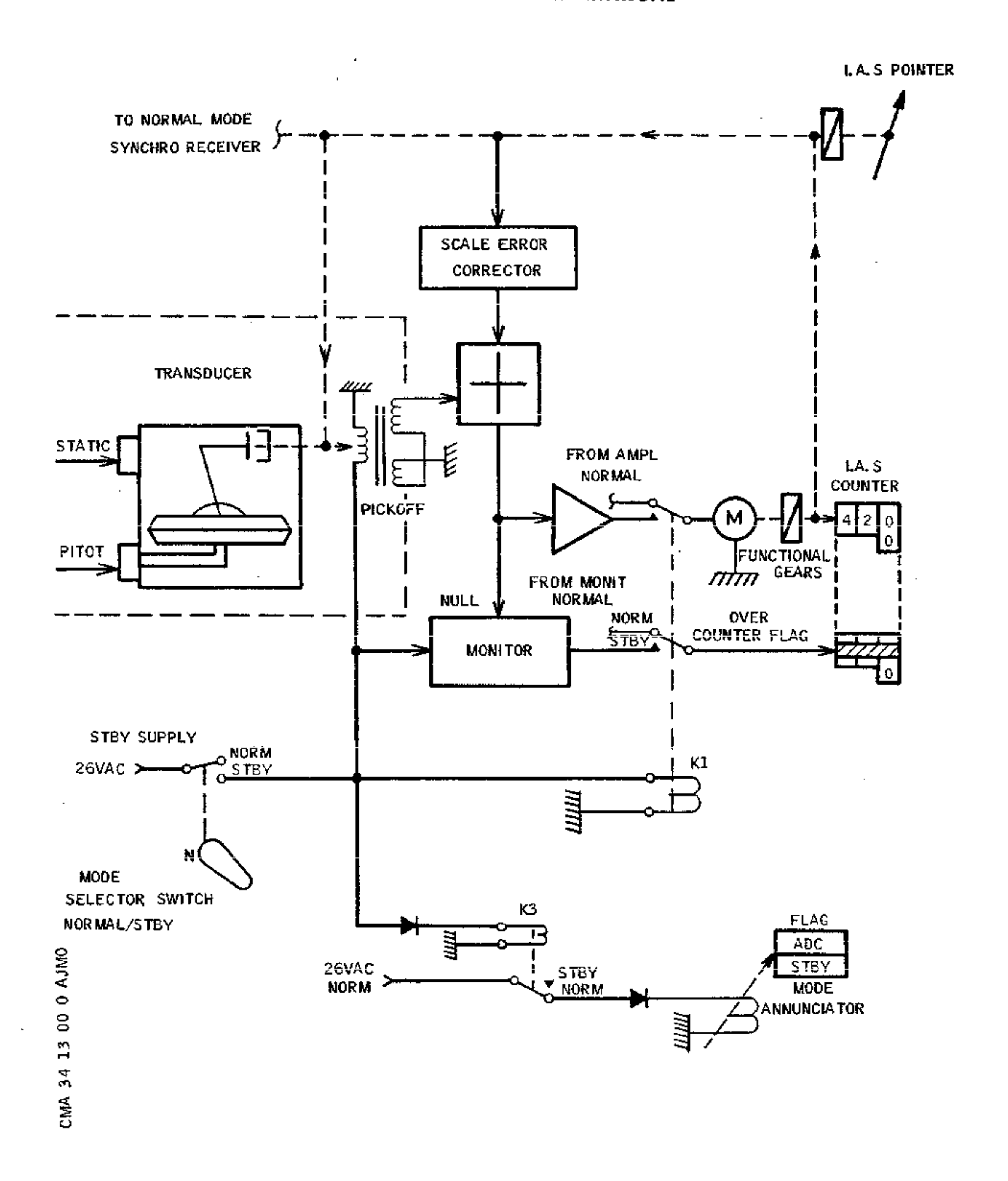
The pick off windings generate an error signal which is summed with a voltage from a scale error correction matrix. This correction is applied in 12 increments from 60 to 550 Kts. A relay (K1) energized from the mode selector switch in STBY position controls switching of standby mode functions.

The servo-motor enables control of :

- counter and airspeed pointer
- input synchro-receiver
- a pick off detector linked to an aneroid capsule, to obtain a null at the servo-amplifier input
- the scale error correction device.

(c) Monitoring

The monitor system provides a check of :



Airspeed Indicator : Standby Mode
Figure 005

- presence of 26VAC power supply
- servo-error.
  If a fault is detected, a black striped fire-orange flag masks the counter drum.

(d) Mode annunciator

According to the position of the NORMAL/STBY mode selector switch, relay K3 causes the appearance of the annunciator flag in ADC or STBY mode.

5. Altimeter

A. General

The altimeter is an instrument with an incorporated Standby facility which gives altitude indications according to the mode of operation (Normal or Standby) selected by means of a selector switch on the front of the instrument.
In STBY mode it supplies altitude information from static pressure measurements made by a built-in transducer.
In NORMAL mode it repeats altitude information transmitted by an air data computer.

(1) Normal mode

(Ref. description and operation, 34-11-10).

(2) Standby mode

(a) Description (Ref. Fig. 006)

(Ref. paragraph 2, 34-11-10).

(b) Operation (Ref. Fig. 007)

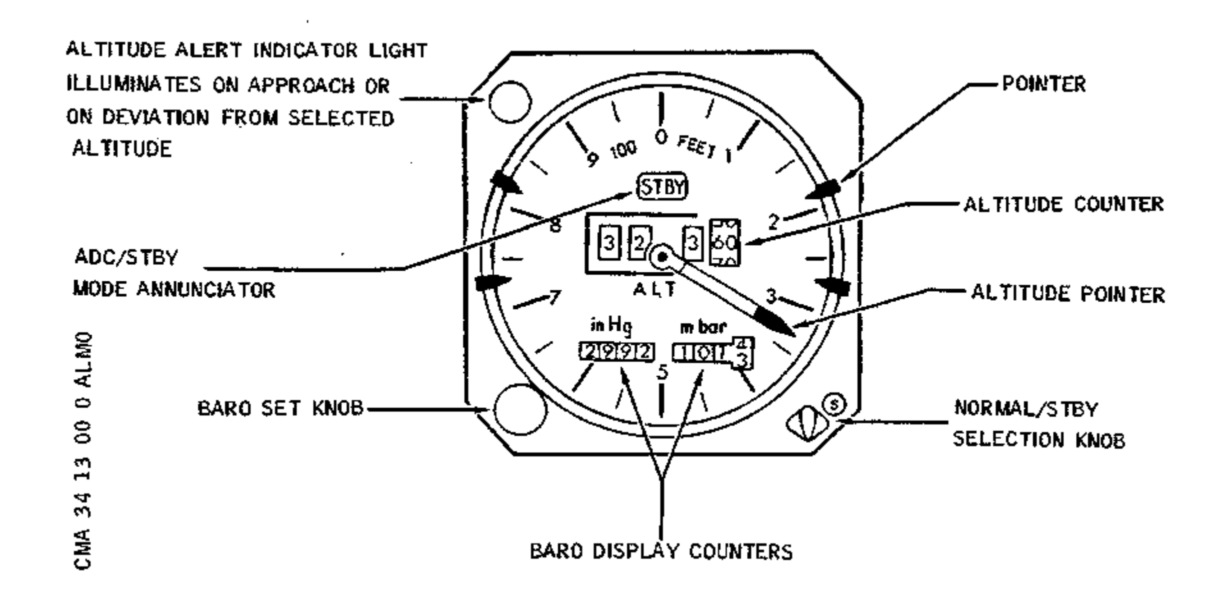
(b1) Transducer

Static pressure information is applied to the pick off detector by means of an aneroid capsule. The error signal generated by the detector is sent to a servo motor control amplifier.

(b2) Servo-control

A relay, energized from the mode selector switch when in STBY position makes the following connections :

- amplifier to servo-motor



Altimeter : Front View
Figure 006

- monitor to flag control stage
  the servo-motor enables control of :
- counter and altitude pointer
- FINE and COARSE altitude output synchro-transmitters
- Normal mode input synchro-receivers
- pick off detector for nulling of error signal.

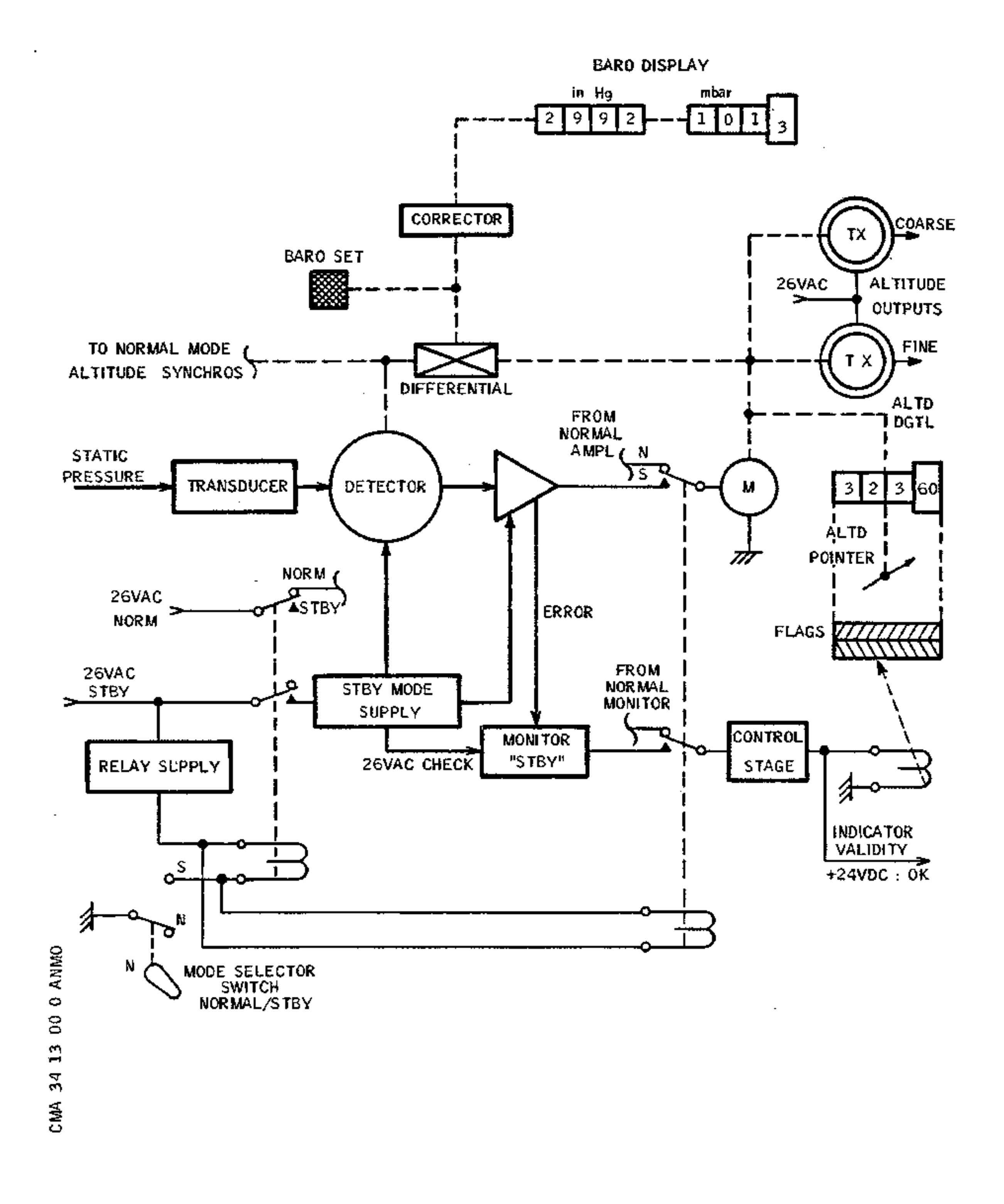
A manual control is used for baro-altimetric setting of the counters, and for altitude setting by means of a differential in the altitude indication servo-loop.

(c) Monitoring

The STBY mode monitor system checks :

- presence of 26VAC power
- servo system error signal level.

When a fault is detected, two flags mask the



Altimeter : Standby Mode
Figure 007

counter display and the indicator validity signal is cancelled.

R 6. Altimeter Standby

R B Standby Altimeter is removed from all BA airplanes Ref. CM 42517
R B Iss.C.

R 7. System Operation

R B (Ref. Fig. 001)
The nose probe (H125), which produces Ps and Pt information, is connected to various instruments and to the pressure sensor unit transmitter by lines fitted at different points with drain valves which enable drainage of water due to condensation.

A. Standby static pressure (Ps) and total pressure (Pt) are sent to

(1) The airspeed/mach indicator (F49) installed on the Captain instrument panel.

(2) The pressure sensor unit transmitter (2K1801A) which forms part of the engine air intake control system.

NOTE : These two instruments operate using these two standby air pressure data sources only.

(3) The two airspeed indicators (1F81 and 2F81) installed on the Captain and First Officer instrument panels.

NOTE : These two instruments can operate either in NORMAL mode using signals from the ADC, or in STANDBY mode using the two standby air pressure data sources.

B. Standby static pressure (Ps) is sent to

R B (1) Not applicable, standby altimeter removed per CM 42517
R B iss.C.

(2) The two altimeters (1F79 and 2F79) installed on the Captain and First Officer instrument panels.

NOTE : These two instruments can operate either in NORMAL mode using signals from the ADC, or in STANDBY mode using standby static pressure data.

STANDBY AIR DATA COMPUTATION - TROUBLE SHOOTING

CAUTION : OBSERVE THE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defects can be isolated with the aid of the trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

The nose probe simultaneously supplies the standby instruments on the Captain and First Officer instrument panels. Trouble shooting procedures are described for the Captain position, for First Officer position refer to identifiers in parentheses.

2. Prepare

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Pressure Generator	
Adapter - Nose Probe	E21922
Cover - Nose Probe Pitot Head	E935021000
Access Platform - Height of Access 4.240 m (13 ft 11 in)	

B. Preliminaries

(1) Position access platform under nose probe.

(2) Remove protective cover (E935021000) if necessary.

(3) Connect adapter (E21922) to nose probe and connect to pressure generator.

(4) On Captain (1F79) and First Officer (2F79) altimeters on instrument panels 2-211 and 2-212 respectively, select on counters by means of knob in lower LH corner barometric pressure of 1013 mb (29.92 in Hg).

(5) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(6) Switch on electronics rack ventilation system (Ref. 21-21-00).

(7) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
1ST PLT ALT ASI STBY IND	2-213	1F 88	B 1
2ND PLT ALT ASI STBY IND		2F 88	B 2

(8) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STBY PITOT HTR SUP	2-213	H 121	F18
SENSOR UNIT 2 SUP	13-216	2K2052	B 4

(9) Start up pressure generator.

(10) Turn mode selector knobs on altimeter 1F79 (2F79) and airspeed indicator 1F81 (2F81) to cause letter S to appear (Standby).

R
R B (11) Not applicable, standby altimeter removed per
R B CM42517 iss. C.

(12) On LH electronics rack, zone 215, remove panel 215BS and make certain on shelf 6-215 that pressure cap S01 is in position. Install panel 215BS.

3. Trouble Shooting

```
**************************************************
* With airspeed indicator [1], ([2]) and altimeter   *
* [3], ([4]) in STBY position, check that flags have *
* disappeared. IF                                     *
**************************************************
      ||   |       ------------------------------------------
      ||   | .     | Flag visible on one indicator only.    |
      OK   |-NOT OK--| Replace indicator.                   |
      ||   |       ------------------------------------------
      ||   |       ------------------------------------------
      ||   |       | Flags remain visible on indicators.    |
      ||   |-NOT OK--| Ref. Chart 101.                      |
      ||           ------------------------------------------
 **************************************************
 * Carry out leak test using either one of the foll-  *
 * owing procedures :                                  *
 * (1) On pressure generator slowly select Ps 116 mb  *
 *     (3.43 in. Hg) and Δp 600 mb (17.72 in. Hg).    *
 *     On airspeed indicator [1], ([2]) read Vc 558   *
R B*     Kts approximately. On altimeter [3],([4])      *
 *     read Hp 50000 ft approximately. On airspeed    *
 *     mach indicator [7] read Vc 558 Kts and M 2.1.  *
 *     Isolate the air data system from the pressure  *
 *     generator. Ps system: after 5 minutes differ-  *
 *     ence in values read on altimeters must not     *
 *     exceed 1500 ft. Pt system: after 10 minutes    *
 *     difference in values read on airspeed indic-   *
 *     ators must not exceed 3 Kts.                   *
 * (2) On pressure generator slowly select Ps 300 mb  *
 *     (8.86 in. Hg) and ΔP 425 mb (12.55 in. Hg).    *
 *     On airspeed indicator [1], ([2]) read          *
R B*     Vc 480 Kts approximately. On altimeter [3],    *
 *     ([4]) read Hp 30060 ft approximately. On       *
 *     airspeed mach indicator [7] read Vc 480        *
 *     data system Kts and M 1.2) approximately.      *
 *     Isolate the air data system from the pressure  *
 *     generator. Pr system : after 10 minutes dif-   *
 *     ference in value read on altimeters must not   *
 *     meters must not exceed 600 ft. Pt system:      *
 *     After 10 minutes difference in value read on   *
 *     airspeed indicators must not exceed 3 Kts. IF  *
 **************************************************
      ||   |
      ||   |
```

```
      ||   |
      OK   NOT OK
      ||   |
      ||   |
      ||   |            ------------------------------------------
      ||   |            | Locate leak in Ps and Pt system.       |
      ||   |------------| Replace defective component.           |
      ||                ------------------------------------------
   ****************************************************
   * Select on pressure generator Ps 977.16 mb (28.86  *
   * in. Hg) and Δp 32.13 mb (0.95 in. Hg). Read on    *
   * airspeed indicator [1], ([2]) Vc 140 Kts          *
R B* ± 4 Kts. Read on altimeter [3],([4]) HP           *
   * 1000ft ± 30 ft. Read on airspeed mach indicator   *
   * [7] Vc 140 Kts ± 4 Kts and VMO 320 Kts ± 5 Kts.   *
   * Select on pressure generator Ps 300 mb (8.86 in.  *
   * Hg) and Δp 425 mb (12.55 in. Hg). Read on air-    *
   * speed indicator [1], ([2]) Vc 480 Kts ± 3 Kts.    *
R B* Read on altimeters[3],([4]), Hp 30060ft ±         *
   * ± 250 ft. Read on airspeed mach indicator [7] Vc  *
   * 480 Kts ± 7 Kts, VMO 400 Kts ± 5 Kts and M 1.2    *
   * ± 0.025.                                          *
   * Select on generator Ps 71.71 mb (2.12 in. Hg) and *
   * Δp 246.86 mb (7.29 in. Hg). Read on airspeed      *
   * indicator [1], ([2]) Vc 375 Kts ± 3 Kts. Read     *
R B* on altimeter [3],([4]), Hp 60000 ft ± 500 ft.     *
   * Read on airspeed mach indicator [7] Vc 375 Kts,   *
   * VMO 440 Kts ± 7 Kts and M 1.75 ± 0.25. IF         *
   ****************************************************
      ||   |
      ||   |            ------------------------------------------
      OK   |            | Replace indicator which displays incorrect |
      ||   |-NOT OK--| values.                                  |
      ||                ------------------------------------------
  ****************************************************
  * Standby system is operational.                    *
  ****************************************************
```

```
*************************************------------------------------
* FLAGS REMAIN VISIBLE ON INDICATORS *| GROUND EQUIPMENT REQUIRED |
*************************************------------------------------
                                      | DESCRIPTION      PART NO  |
                                      -----------------------------
                                      | MULTIMETER                |
                                      -----------------------------

         ******************************************
         * Measure 28VDC at circuit breaker output *
         * [5], ([6]).                             *
         ******************************************
                           |
                           0 V
                           |
                ----------------------------------
                | Replace circuit breaker [5],   |
                | ([6]).                         |
                ----------------------------------
```

Chart 101

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] Airspeed indicator		2-211	1F81	Captain instrument panel	34-13-23 R/I	34-11-02
[2] Airspeed indicator		2-212	2F81	F/O instrument panel	34-13-23 R/I	34-11-07
[3] Altimeter		2-211	1F79	Captain instrument panel	34-13-24 R/I	34-11-01
[4] Altimeter		2-212	2F79	F/O instrument panel	34-13-24 R/I	34-11-06
[5] Circuit breaker		2-213	1F88	Map Ref. B 1	24-50-00 R/I	34-10-01
[6] Circuit breaker		2-213	2F88	Map Ref. B 2	24-50-00 R/I	34-10-01
[7] Mach airspeed indicator		2-211	F49	Captain instrument panel	34-13-22 R/I	34-10-00

R B[8]NOT APPLICABLE - STBY ALTIMETER REMOVED PER CM 42517 155 C

R **ON A/C ALL

Component Identification
Table 101

STANDBY AIR DATA INSTRUMENTATION - MAINTENANCE PRACTICES

1. Leak Checks

A. A leak check must be performed if :

(1) Any connection in the STANDBY pitot/static system is disturbed e.g. Pitot/Static Nose Probe, Altimeter, Airspeed Indicator, Combined Speed Indicator, Standby Altimeter, and No. 2 "Air Intake Sensor Unit" (Ref. Chapter 71).)

(2) Any pitot/static connections, other than the quick release type are disturbed in any pitot/static system e.g. Pitot Heads, Static Vents and Drain Taps.

B. No leak check is required if only one pitot and one static quick release connections on only one system are disturbed e.g. a single ADC change or a single Air Intake Sensor Unit change.

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Adapter - Nose probe	E21922
Pressure generator	
Electrical Ground Power Unit	
Access Platform - 4.240 m (13 ft. 11 in.)	
Cover - Nose Probe Pitot Head	E935021000

B. Prepare

(1) Position access platform under nose probe.

(2) Remove cover, P/N E935021000, if required.

(3) Connect adapter, P/N E21922, to nose probe and to pressure generator.

R
R (4) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

R (5) Switch on electronics racks ventilation system (Ref. 21-21-00).

R (6) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
1ST PLT ALT ASI STBY IND	2-213	1F 88	B 1
2ND PLT ALT ASI STBY IND		2F 88	B 2

R (7) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STBY PITOT HTR SUP	2-213	H 121	F18
SENSOR UNIT 2 SUP	13-216	2K2052	B 4

(8) Start-up pressure generator

(9) Use baro set knob in lower LH corner of altimeters to set barometric pressure as follows :

(a) 1013 mb (29.92 in. Hg.) read on barometric display counters of Captain and First Officer altimeters on instrument panels 2-211 and 2-212.

(b) 29.92 in. Hg. read on barometric pressure display counter on standly altimeter on panel 2-211.

R B (10) Not applicable stby Altimeter removed per CM42517 iss C.

R B (11) Not applicable stby Altimeter removed per CM42517 iss C.

C. Tests

NOTE : If a conventional pressure generator is used which does not permit selection of a 50000 ft. altitude and mach 2.07, carry out a test at 30000 ft. using values in parentheses.

(1) On Captain's and First Officer's airspeed indicators and altimeters, turn selector knob located at lower right of the dials to display letter S on indicators. cators.

(a) Check that mode annunciator flag reads STBY.

(2) On pressure generator, by means of pressure control, slowly select :

(a) Static pressure (Ps) = 116.3mb or [300mb]

(b) Differential pressure (Delta P) = 580mb or [350mb]

(3) On Captain instrument panel 2-211, check

(a) On altimeter that indicated altitude is 50000 ft.

R B (b) Not applicable.

(c) On airspeed/mach indicator that indicated airspeed is 550 kt ± 6 kt, mach number is 2.07 ± 0.03 and that checkered VMO pointer indicates 530 kt ± 7 kt or [airspeed = 400 kt ± 6 kt, mach number = 1.11 ± 0.03, VMO = 400 kt ± 7 kt].

(4) On First Officer instrument panel 2-212 check :

(a) On altimeter that indicated altitude is 50000 ft. ± 280 ft. or [30060 ft. ± 250 ft.].

(b) On airspeed indicator that indicated airspeed is 550 kt ± 3 kt or [440 kt ± 3 kt].

(5) Isolate the pressure generator standby system to ensure that system is sealed and check :

(a) That after 5 minutes or [10 minutes], on altimeters, indicated deviation does not exceed 1500 ft.
R or [600 ft.].

(b) That after 10 minutes, on Captain and First Officer airspeed indicators and on Captain airspeed/mach indicator, indicated airspeed deviation does not exceed 3 kt.

(6) On pressure generator, slowly return pressures (Ps and Delta P) to normal.

D. Close-Up

(1) Vent standby system to atmosphere, then check that Captain's and First Officer's altimeters, airspeed indicators and airspeed/Mach indicator return to initial values.

(2) On Captain's and First Officer's airspeed indicators and altimeters, place selector knob located at lower left in N position.

(3) Remove adapter P/N E21922, from nose probe and install cover, P/N E935021000.

(4) Remove access platform from under nose probe.

(5) Switch off electronics racks ventilation system (Ref. 21-21-00).

(6) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(7) Reset circuit breakers previously tripped in paragraph
R 1-B-(7).

2. Functional Test

A. Equipment and Materials

Ref. paragraph 1A of operational test.

B. Prepare

Ref. paragraph 1B of operational test.

C. Tests

(1) On Captain's and First Officer's airspeed indicators and altimeters, turn selector knob located at lower right of the dials to display letter S on indicators.

- Check that mode annunciator flag reads STBY.

(2) On pressure generator slowly select static pressures (Ps) and differential pressure, (Delta P) per table below, then check that the readings on Captain's and First Officer's indicators on instrument panel comply with the following values :

PRESSURE SELECTED	Ps = 942 mb Delta P = 123 mb	Ps = 262 mb Delta P = 284 mb	Ps = 72 mb Delta P = 247 mb
CAPT & F/O ALTIMETERS	Hp = 2000 ft ± 30	Hp =33000 ft ± 200	Hp =60000 ft ± 500
R **ON A/C ALL			
R BSTANDBY R BALTIMETER	NOT APPLICABLE	(Removed per CM42517 Iss C.)	
R **ON A/C ALL			
CAPT & F/O AIRSPEED INDICATORS	Vc = 270 kt ± 3	Vc = 400 kt ± 3	Vc = 375 kt ± 3
CAPT AIRSPEED/ MACH INDICATOR	Vc = 270 kt ± 5 M = 0.42 ± 0.03 VMO = 330 kt ± 7	Vc = 400 kt ± 5 M = 1.08 ± 0.03 VMO = 400 kt ± 7	Vc = 375 kt ± 5 M = 1.75 ± 0.03 VMO = 440 kt ± 7

(3) Isolate pressure generator standby circuit in order to check the circuit for possible leakage, then check :

(a) On altimeters that the variation indicated after 5 minutes is not greater than 1500 ft.

(b) On Captain's and First Officer's airspeed indicators and on airspeed/Mach indicator that the variation in airspeed Vc indicated after 10 minutes is not greater than 3kts.

(4) On pressure generator, slowly return pressures (Ps and Delta P) to normal.

D. Close-Up

Ref. paragraph 1D of operational test.

3. System Test

Identical with operational test, Ref. paragraph 2.

AIRSPEED/MACH INDICATOR - MAINTENANCE PRACTICES

1. Leak Checks

A. A leak check must be performed if :

(1) Any connection in the STANBY pitot/static system is disturbed.

(2) More than one pitot and one static quick release connection is disturbed in one main system e.g. No.2 ADC.

(3) Any quick release connection in both main pitot/static systems is disturbed (both systems must be leak checked) e.g. interchange of ADC's.

(4) Any pitot/static connections, other than the quick release type are disturbed in any pitot/static system e.g. Pitot Heads, Static Vents and Drain Taps.

B. No leak check is required if only one pitot and one static quick release connections on only one system are disturbed e.g. a single ADC change.

R

AIRSPEED/MACH INDICATOR - REMOVAL/INSTALLATION

1. General

The airspeed/mach indicator is installed on the Captain instrument panel 2-211. As the instrument is operated by air pressure, the Static and Pitot flexible lines are disconnected at the pressure couplings after previous removal of other instruments.

2. Removal/Installation

A. Equipment and Materials.

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connector	
Blanking Caps for Pressure Lines and Connectors	
'O' Ring Seals	

B. Prepare.

(1) On Captain instrument panel 12-211, make certain that LH DASH INSTRUMENTS knob is in OFF position.

(2) On panel 13-215, trip, safety and tag LH DASH INST LTS SUP circuit breaker L372, map ref. A12.

C. Removal of Pressure Lines (Ref. Fig. 401)

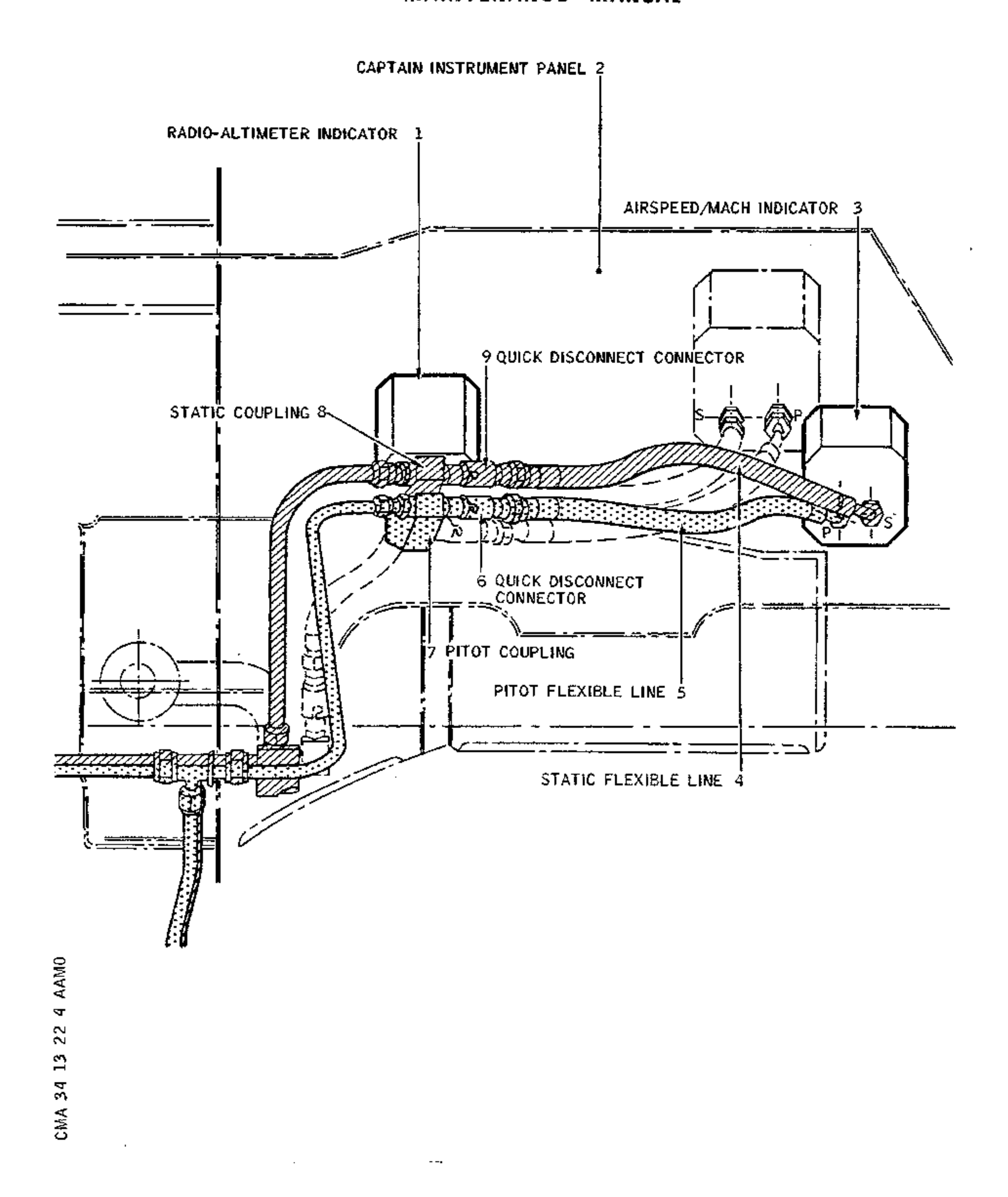
(1) On Captain instrument panel (2) remove radio-altimeter indicator (1) (Ref. 34-42-21, Removal/Installation).

(2) Through radio-altimeter aperture, disconnect upper connectors from pressure couplings (7) and (8) :

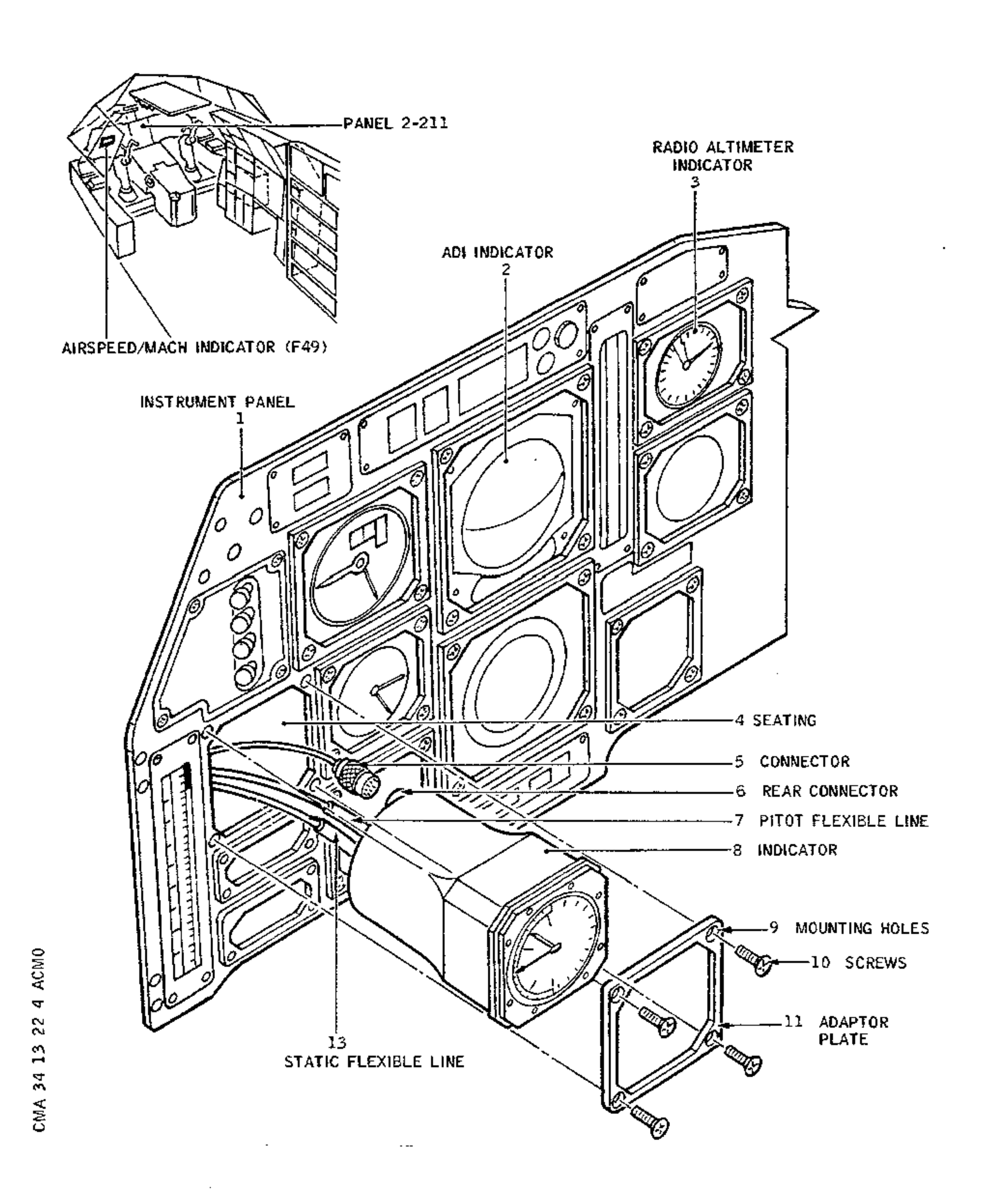
(a) Static flexible line (4) by means of Quick Attach/Disconnect connector (QAD) (9).

(b) Pitot flexible line (5) by means of QAD (6).

D. Removal of Airspeed/Mach Indicator (Ref. Fig. 402)



Removal/Installation of Pressure Lines
Figure 401



Removal/Installation of Airspeed/Mach Indicator
Figure 402

(1) Loosen and remove four adaptor plate (11) mounting screws (10)

(2) Remove adaptor plate (11)

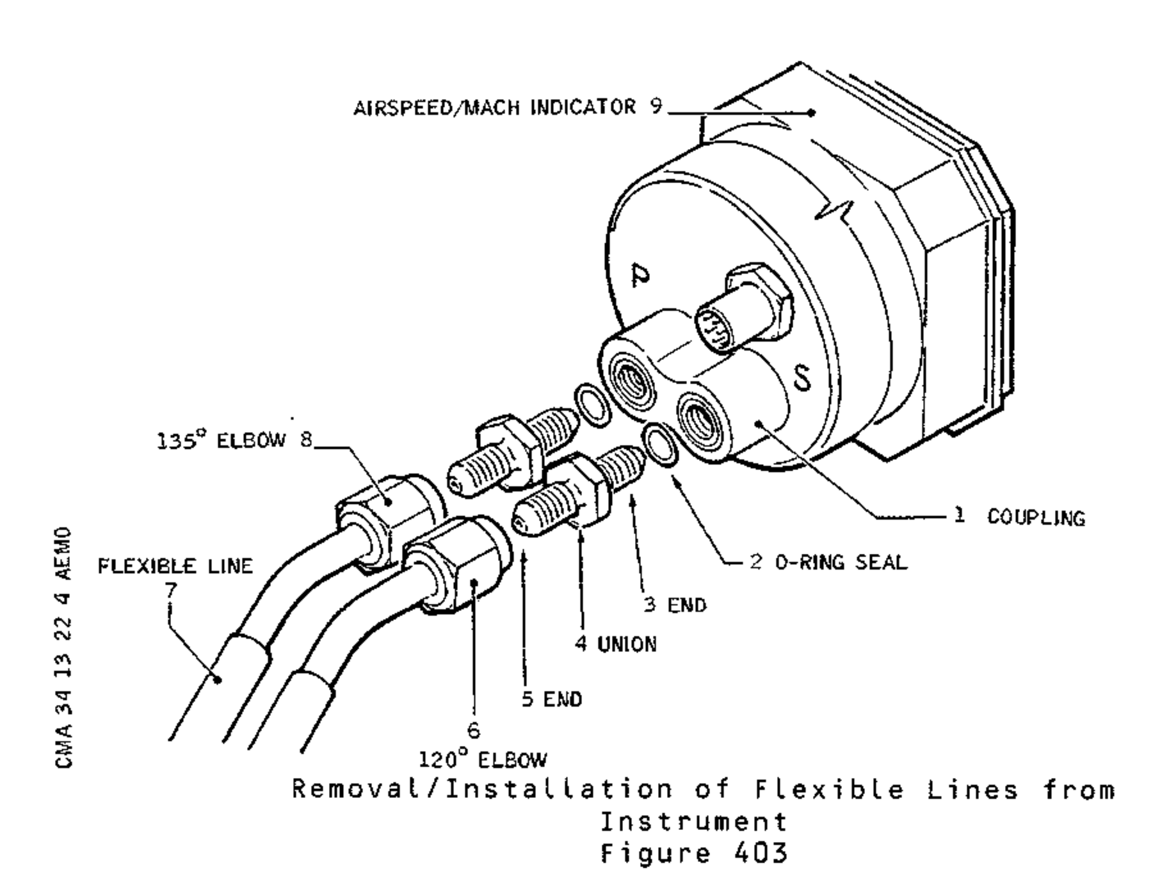
(3) Remove airspeed/mach indicator (8) from seating (4), guiding flexible lines (7) and (13) through ADI (2) seating.

(4) Withdraw indicator (8), supporting flexible lines, then remove aircraft connector (5) from indicator rear connector (6).

(5) Blank off upper connectors on pitot and static couplings.

(6) Blank off connectors (5) and (6)

E. Preparation of Replacement Component (Ref. Fig. 403)



Removal/Installation of Flexible Lines from Instrument
Figure 403

(1) Removal of flexible Pitot line.

(a) unscrew union (4) from 135° elbow (8).

(b) On airspeed/mach indicator (9) unscrew union from P coupling (1) on instrument.

(c) Blank off :

(c1) 135° elbow on flexible line (7).

(c2) Ends A (5) and B (3) of union (4).

(c3) P coupling (1) on indicator.

(2) Removal of flexible Static line.

(a) Unscrew union (4) from 120° elbow (6).

(b) On airspeed/mach indicator (9) unscrew union from S coupling (1) on instrument.

(c) Blank off :

(c1) 120° elbow on flexible line (7).

(c2) Ends A (5) and B (3) on union (4).

(c3) S coupling (1) on indicator.

(3) Make certain that instrument seating is clean and aircraft electrical wiring is in correct condition.

(4) On replacement airspeed/mach indicator :

(a) Make certain that indicator is in good external condition.

(b) Remove blanking caps from P and S coupling S (1).

(5) Remove blanking caps from ends A and B of unions (4).

(6) Install flexible Pitot lines.

(a) On end B (3) of union (4), install new O ring seal (2)

(b) Connect end B of union to P coupling (1) on instrument (9) and torque union (4) to between 1.20 and 1.30 m.daN (105-115 lbf.in.)

(c) Remove blanking cap from 135° elbow (8).

R (d) By means of 135° elbow, connect and tighten flexible line (7) to end A (5) of union (4).

(7) Installation of Static flexible line.

R (a) On end B (3) of union (4), install a new O ring seal (2)

R (b) Connect end B of union to S coupling (1) of instrument (9) and torque union (4) to between 1.65 and 1.75 m.daN (145-155 lbf.in.).

(c) Remove blanking cap from 120° elbow (6).

R (d) By means of 120° elbow, connect and tighten flexible line (7) to end A (5) of union (4).

F. Installation of Airspeed/Mach Indicator (Ref. Fig. 402)

(1) Remove blanking caps from connectors (5) and (6).

(2) Position indicator (8) in front of seating (4) and connect aircraft connector (5) to indicator rear connector (6).

(3) Insert indicator in its seating, guiding flexible lines (7) and (13) through ADI seating, push indicator fully against instrument panel (1).

(4) Position adaptor plate (11). Install and tighten four mounting screws (10) in adaptor plate holes (9).

G. Installation of Pressure Lines. (Ref. Fig. 401)

(1) Remove blanking caps from Static and Pitot upper connectors on pressure couplings (7) and (8).

(2) Through radio altimeter seating (1) connect upper connectors on pressure couplings :

(a) Flexible Pitot line (5) by means of QAD (6).

(b) Flexible Static line (4) by means of QAD (9).

(3) On Captain instrument panel (2) install radio altimeter (1) (Ref. 34-42-21, Removal/Installation).

R H. Close-Up

(1) Remove safety clips and tags and reset circuit breaker LH DASH INST LTS SUP L372, map ref. A12.

(2) Carry out an operational test (Ref. 34-13-00, Adjustment, Test).

R

AIRSPEED INDICATOR - REMOVAL/INSTALLATION

1. General

Two airspeed indicators are installed on the aircraft, one on the Captain instrument panel and the other on the First Officer instrument panel.
These indicators may be used either in NORMAL mode of operation, or in STANDBY mode.
In NORMAL mode, the indicator repeats airspeed information sent from an air data computer.
In STANDBY mode, it provides airspeed information using static and total pressures picked off by the nose probe.
The static pressure and total pressure lines shall be disconnected at the pressure couplings located behind the instrument panels.

2. Removal/Installation

Refer to 34-11-15, Removal/Installation.

ALTIMETER - REMOVAL/INSTALLATION

1. General

Two altimeters are installed on the aircraft, one on the Captain instrument panel and the other on the First Officer instrument panel.
These altimeters may be used either in NORMAL mode of operation, or in STANDBY mode.
In NORMAL mode, the altimeter repeats altitude information sent from an air data computer.
In STANDBY mode, it provides altitude information using static pressure picked off by the nose probe. The static pressure lines shall be disconnected at the pressure couplings located behind the instrument panels.

2. Removal/Installation

Refer to 34-11-13, Removal/Installation.

NOSE PROBE - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

The nose probe is a pitot static head designed to provide aerodynamic compensation of static position error.
It supplies precise pitot and static pressure values to the aircraft systems. An incorporated heating element, supplied by an automatically regulated 115VAC supply dissipates power inversely proportional to ambient temperature. Power dissipated in flight does not generally exceed 460 Watts. At 20°C ambient temperature, power is less than 270 Watts. Design of the pitot intake and installation of static ports enable accurate measurements to be made in all configurations of angle of attack and sideslip. The pitot system has an indirect intake to avoid entry of foreign objects into the aircraft system.

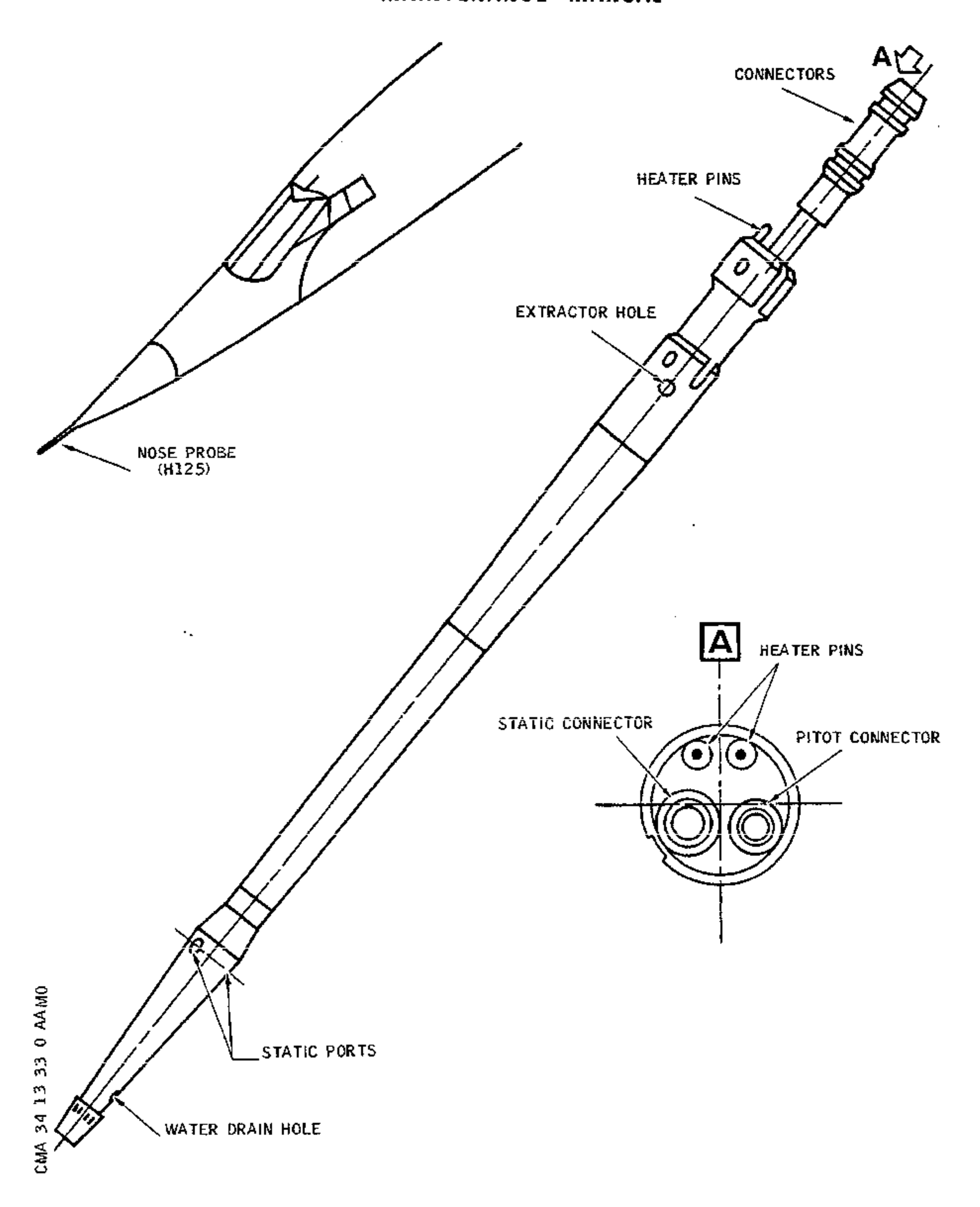
2. Description - Operation

A. Total Static Pressure

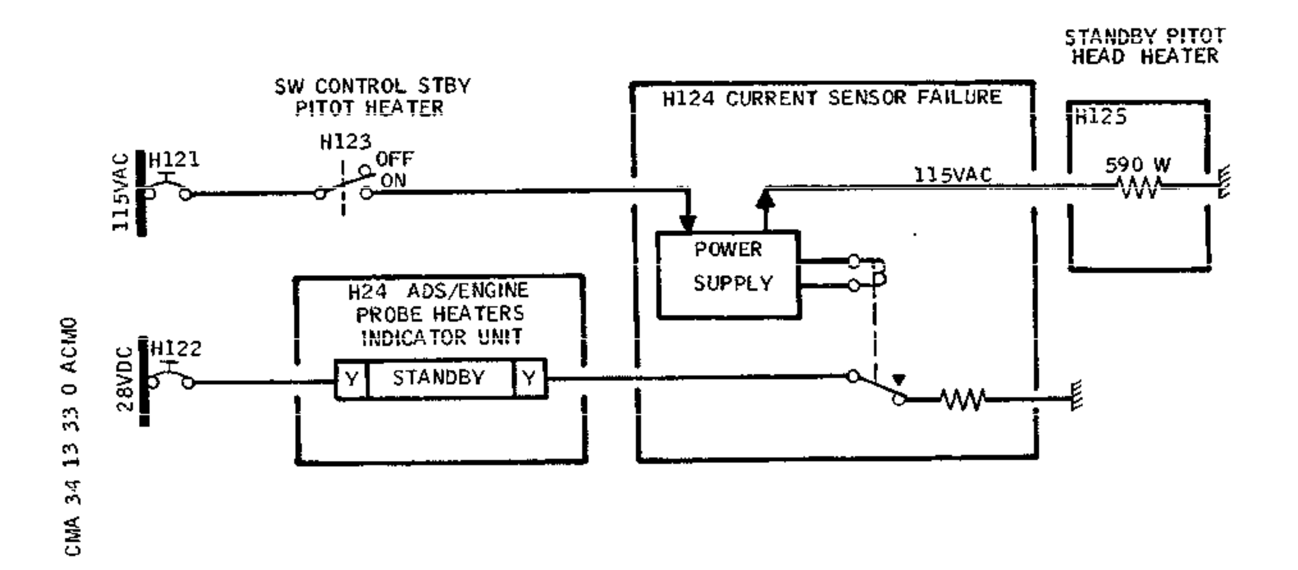
Dynamic pressure is transmitted from the pitot intake via the indirect intake to the aircraft system through a line.
A drain hole is provided for water drainage.
The pressure at the static ports is influenced by the airflow over the special contour and this compensated pressure is fed to the aircraft system by means of a line.

B. Heating (Ref. Fig. 002)

The heating system is designed to operate from a nominal 115VDC or 115VAC single phase supply.
Circuit breakers (H121) and (H122) being set when switch (H123) is in ON POSITION, the nose probe (H125) is supplied with 115VAC heater voltage via the CURRENT SENSOR FAILURE circuit (H124). When the circuit is energized by 115VAC, it energizes a relay which causes STANDBY indicator light (H24) in zone 4-211 to extinguish.



Nose Probe : Side View
Figure 001



Heating : Nose Probe Power Supply
Figure 002

NOSE PROBE - MAINTENANCE PRACTICES

1. Leak Checks

   A. Leak checks must be performed if any connection in the pitot/static nose probe is disturbed.

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NOSE PROBE - REMOVAL/INSTALLATION

1. General

Removal for exchange or check of pitot static head (H125) in zone 111 at extremity of radome.

R B NOTE : The nose probe is electrically heated for de-icing
R B purposes. If it is switched on when the aircraft is
R B on the ground it gets HOT. Before any maintenance work
R B is carried out in the vicinity of the probe, it must
R B be checked that the relevant probe heating supply is
R B switched off, and a "DO NOT OPERATE" sign is placed on
R B the heater control switch. Ground operation of the
R B probe heater should be kept to a minimum. Heaters
R B should only be operated on the ground, during Mainte-
R B nance, when checking the function of the current sense
R B relays, and correct operation of the heating circuits.
R B The pitot static nose probe heater MUST NOT be switched
R B on under any circumstances when leak testing adaptors
R B or protective covers are fitted.

2. Nose Probe

A. Equipment and Materials

DESCRIPTION	PART NO.
Platform, Height of Access 4.240 m (13 ft. 11 in.)	
Pitot Static Head Line Connector Blanking Caps	
Extractor - Nose Pitot Probe	E925001000
Cover - Nose Probe Pitot Head	E935021000
Circuit Breaker Safety Clips	

B. Prepare

(1) Make certain that droop nose is in ZERO position (Ref. 27-61-00, Adjustment/Test).

(2) On panel 2-213, trip, safety and tag circuit breaker STBY PITOT HTR SUP (H121), map ref F18.

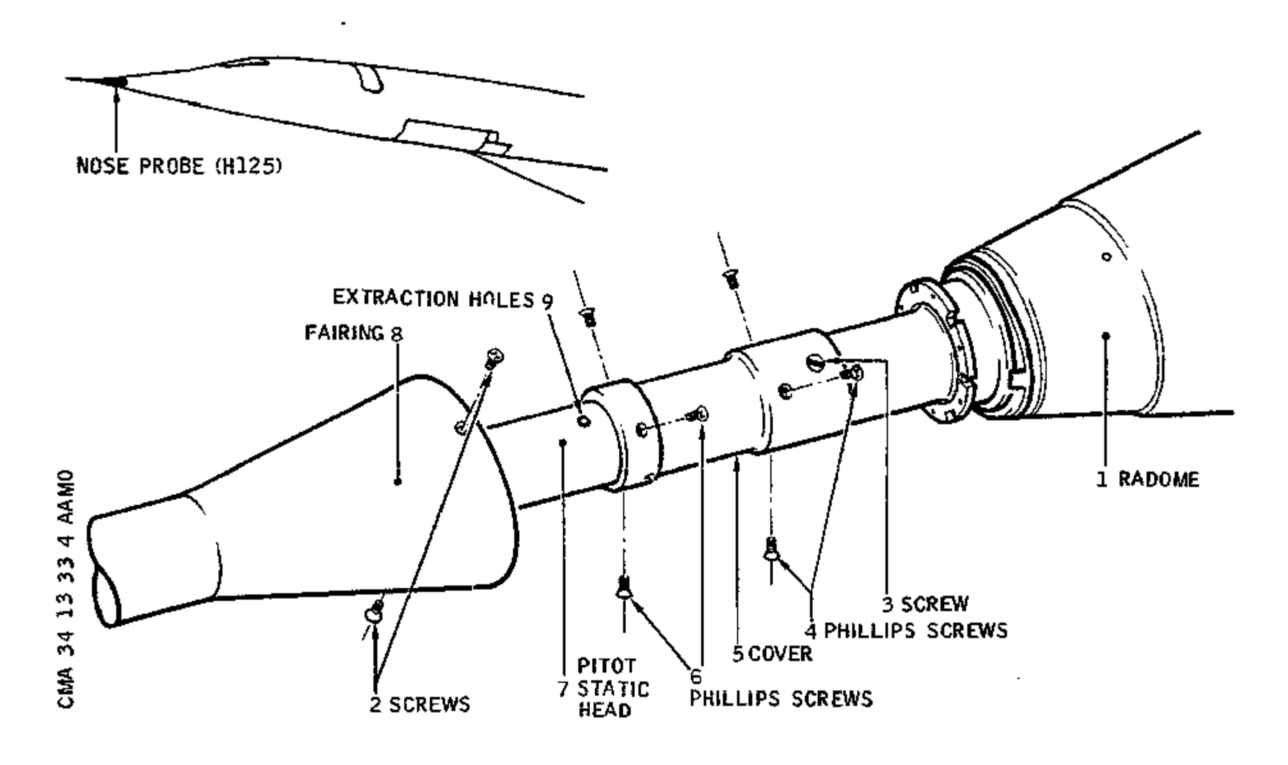
(3) On panel 4-211, make certain that switch ADS AND ENG

PROBE HEATERS STBY ON-OFF is in OFF position.

(4) Place access platform in front of droop nose.

(5) Remove protection cover (P/N E935021000) if fitted.

C. Remove (Ref. Fig. 401)



Pitot Static Head : Removal
Figure 401

(1) Remove two screws (2) on radome (1).

(2) Push fairing (8) forward.

(3) On cover (5) remove three phillips screws (4), then three phillips screws (6).

(4) On cover (5) loosen without removing, two screws (3).

(5) Position nose pitot probe extractor (P/N E925001000) so that its pins locate in extraction holes (9) then by means of tool, remove pitot static head (7) from cover (5).

(6) Place blanking caps on head line connectors.

D. Preparation of Replacement Component

(1) On aircraft, make certain that cover (5) is clean.

(2) On head (7) make certain :

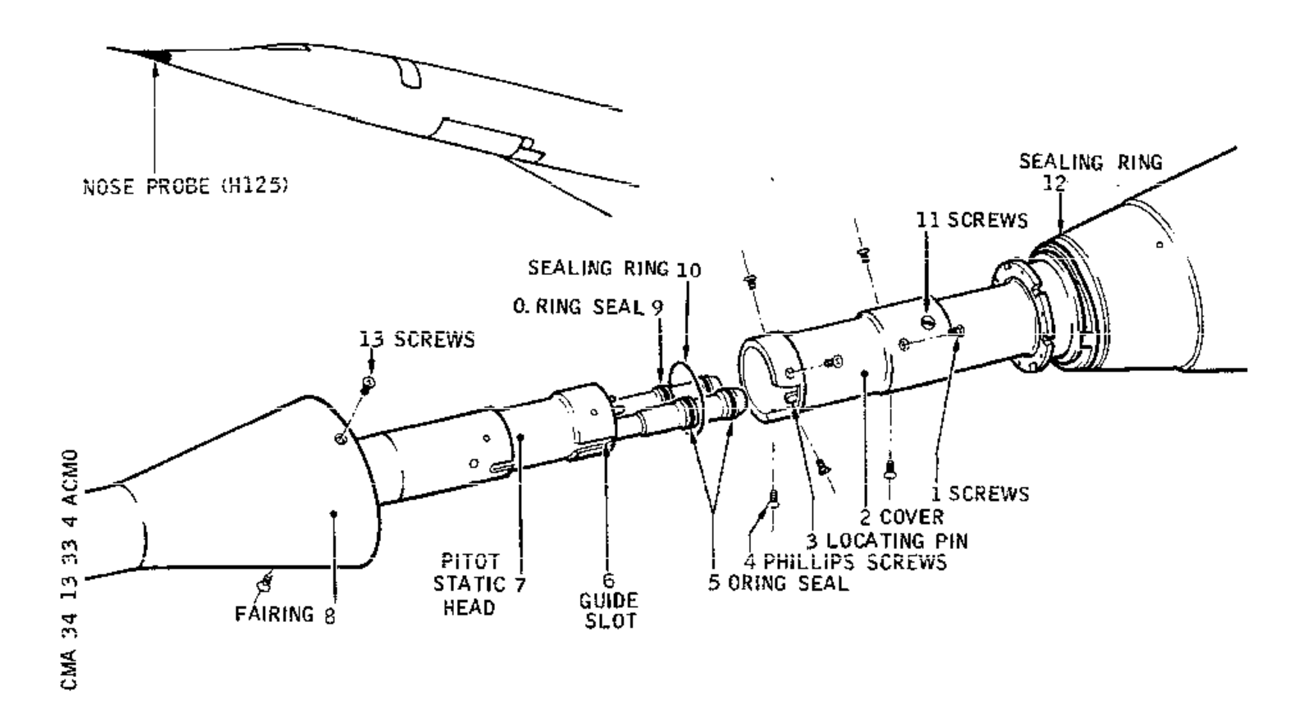
(a) That head has no external signs of damage, abrasions, scratches, etc.

(b) That drain holes, static and total pressure ports are not blocked.

(c) That heating system pins are not bent.

(d) That fixing hole threads are not damaged.

E. Install (Ref. Fig. 402)



Pitot Static Head : Installation
Figure 402

(1) Remove blanking caps from head line connectors.

(2) Install new O-ring seals (5) and (9).

(3) Position head (7), guide slot (6) facing locating pin (3) in cover (2).

(4) Install head (7) in cover (2) until threaded holes in head coincide with holes in cover.

(5) Gently tighten two screws (11).

(6) Install new sealing rings (10) and (12) on fairing (8)

(7) Install without tightening three phillips screws (4) and three screws (1).

(8) Tighten screws (4) and (1).

(9) Install fairing (8).

(10) Install and tighten two screws (13) securing fairing (8) to radome.

F. Tests

(1) On panel 2-213, remove safety clips and tags and reset circuit breaker STBY PITOT HTR SUP (H121) map ref F18.

(2) Carry out an operational test of standby air data system, (Ref. 34-13-00, Adjustment/Test).

(3) Carry out a pitot static head heating test (Ref. 30-31-00, Adjustment/Test).

G. Close-Up

(1) Install protection cover (P/N E935021000).

(2) Remove access platform from droop nose.

NOSE PROBE - INSPECTION/CHECK

1. General

The inspection/check covers the following procedures :

- Visual inspection
- Allowable tolerances in cases of minor defects
- Cleaning of certain vital parts

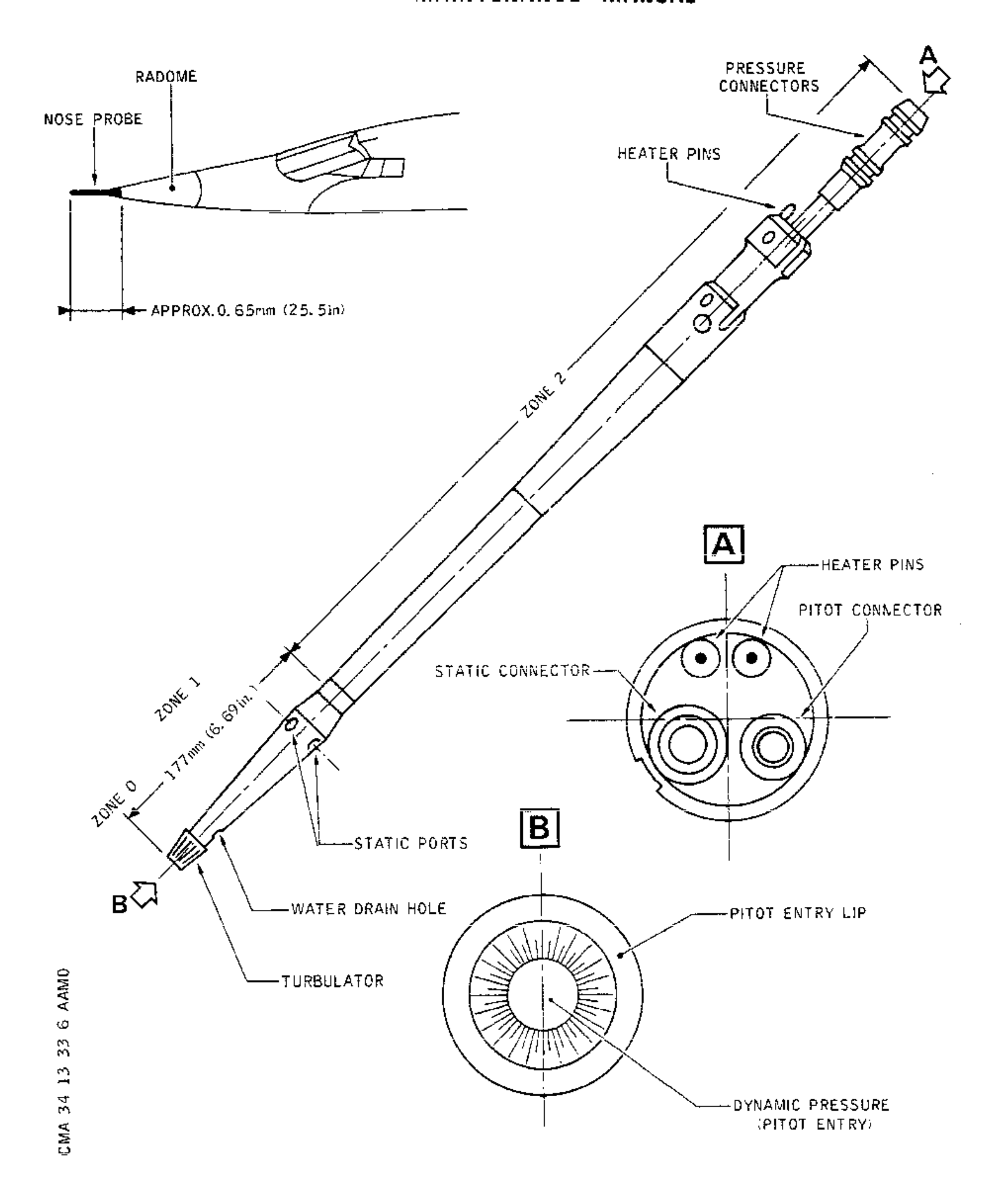
WARNING : THE NOSE PROBE IS FITTED AT THE END OF THE RADOME, PROTRUDING APPROXIMATELY 0.65 M (25.5 IN) AHEAD OF THE AIRCRAFT. IT IS RECOMMENDED DURING INTERMEDIATE AND TERMINAL STOPS THAT ALL NECESSARY PRECAUTIONS BE TAKEN (INSTALLATION OF PROTECTIVE COVER WITH STREAMER, ALLOWANCE OF SAFE DISTANCE BETWEEN PROBE AND MOVING OBJECTS) IN ORDER TO AVOID INCIDENTS WHICH CAN CAUSE DAMAGE AND RENDER THE PROBE UNSERVICEABLE.

R B NOTE : The nose probe is electrically heated for de-icing
R B purposes. If it is switched on when the aircraft is on
R B the ground it gets HOT. Before any maintenance work is
R B carried out in the immediate vicinity of the probe is
R B must be checked that the relevant probe heating supply
R B is switched off, and a "DO NOT OPERATE" sign is placed
R B on the heater control switch. Ground operation of the
R B probe heater should be kept to a minimum. The heater
R B should only be operated on the ground, during Maintenance
R B when checking the function of the current sense relays,
R B and correct operation of the heating circuits.
R B The pitot static nose probe heater MUST NOT be switched
R B on under any circumstances when leak testing adaptor
R B or protective covers are fitted.

2. Nose Probe (Ref. Fig. 601)

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform, Height of Access 4.24 m (13 ft 11 in.)	
Circuit Breaker Safety Clips	
Cover - Nose Probe Pitot Head	E935021000
Cleaning Fluid (Ref. 20-30-00, No.468 or 469)	



Nose Probe/Inspection Check
Figure 601

B. Prepare

(1) Make certain that droop nose is in zero position (Ref. 27-61-00, Adjustment/Test).

(2) On panel 2-213, trip, safety and tag circuit breaker STBY PITOT HTR SUP (H121), position F18.

(3) On panel 4-211, make certain that ADS AND ENG PROBE HEATERS switch is in OFF position.

(4) Position access platform in front of nose probe.

(5) Remove protective cover (Part No. E935021000).

C. Visual Inspection

The visual inspection consists of the following two parts :

(1) With nose probe installed on the aircraft, check that :

(a) On external surfaces, head has no visible signs of damage ; cuts, scratches etc.

(b) Pitot probe entry lip is not damaged.

(c) Static pressure ports are free of burns, scratches and obstructions.

(d) Drain holes are not obstructed.

(2) With nose probe removed from aircraft

(a) Repeat inspections from paragraph 2 C (1) and check in addition that :

(a1) Heater pins are not bent.

(a2) Pressure line connectors are not bent.

(a3) Pressure line connector seals are in good condition.

(a4) Attachment hole threads are not damaged.

D. Allowable tolerances in cases of minor defects

(1) Longitudinal deformation (probe bent)

A maximum displacement 3 mm (1/8 in) [displacement of

the tip with respect to longitudinal axis] is acceptable.

(2) Dents or scores

(a) Zone 0 (probe input)

If the pitot probe entry lip is damaged, nose probe must be replaced.

NOTE : Slight wear at the entry lip is acceptable. Tolerance is 0.21/0.08 mm (0.008/ 0.003 in.).

(b) Zone 1 (from the probe tip to 10 mm (0.393 in.) behind the static pressure ports [Length 177 mm (6.69 in.).

(b1) No dents (impact shock) are acceptable.

(b2) No transversal scoring is acceptable.

(b3) A longitudinal score of depth 0.2 mm (0.078 in.) which does not extend into the area of the static ports (± 10 mm [0.394 in.]) is acceptable.

(c) Zone 2 (behind zone 1)

The allowable defects are similar where they do not affect the integrity of the pressure lines and where longitudinal bending is not greater than the tolerance units given for zone 1.

(3) Operation with damaged nose probe

The nose probe is a NO GO item, it is thus necessary to replace it if damage exceeds the limits prescribed in 2 D (1) and 2 D (2).

E. Cleaning of certain vital parts

(1) Clean with a brush soaked in product No.468 or 469 the Turbulator grooves at the forward part of the probe.

(2) If the static ports are slightly obstructed, clear by means of a copper wire of maximum diameter 0.7 mm (0.028 in.). Take care not to deform the ports.

(3) If the static ports are heavily obstructed, removal of

the nose probe is necessary (Ref. 34-13-33, Removal/ Installation). Connect a compressed air source to the rear pressure connectors and blow out the system (opposite sense to normal operation).
Complete cleaning using a brush soaked in product No. 468 or 469.

F. Tests

(1) On panel 2-213, remove safety clips and tags and reset circuit breaker STBY PITOT HTR SUP (H121) position F18.

(2) Carry out a PITOT STATIC HEAD heating test (Ref. 30-31-00, Adjustment/Test).

(3) Carry out an operational test of the standby air data system (Ref. 34-13-00, Adjustment/Test).

G. Close-Up

(1) Install protective cover (Part No. E935021000).

(2) Remove access platform from droop nose.

1. General

The presentation of attitude and direction parameters on the appropriate indicators enables the Pilot to identify the aircraft position with reference to true, magnetic or radio axes according to the type of information selected.

2. Heading Information
(Ref. Fig. 001)

A. Magnetic Heading Reference System (MHRS)

Magnetic heading is supplied by the compass coupler, which sends it for display to the horizontal situation indicators (HSIs), VOR/RMIs and ADF/RMIs according to switching selection.
The compass coupler operates in two modes :

- MAG mode : magnetic heading is stabilized by platform heading information from the intertial navigation system (INS).
- DG mode : magnetic heading is slaved to platform heading and to 32 bit word INS information.

B. Inertial Navigation System (INS)

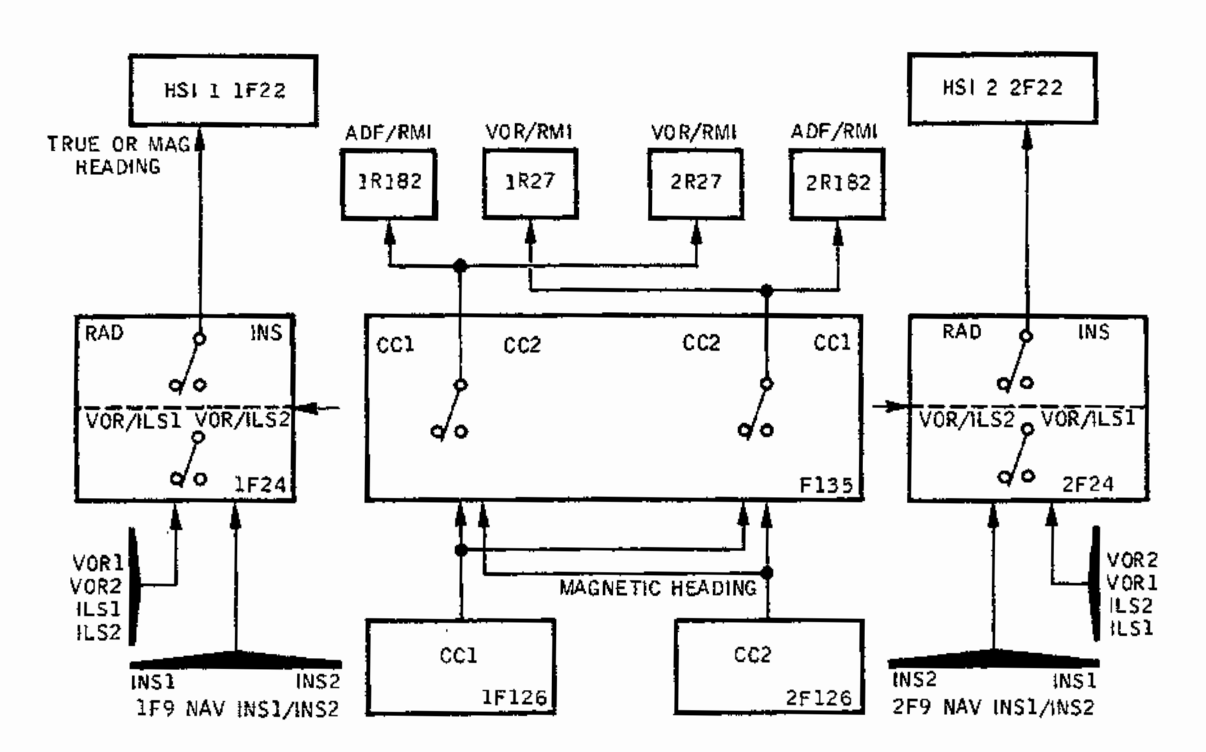
True heading information is supplied by the INS, which sends it for display to the HSI, according to switching selection.
The heading indicated on the HSI is magnetic when the RAD/INS switch is in RAD position, and true when the RAD/INS switch is in INS position. The RMIs always indicate magnetic heading.

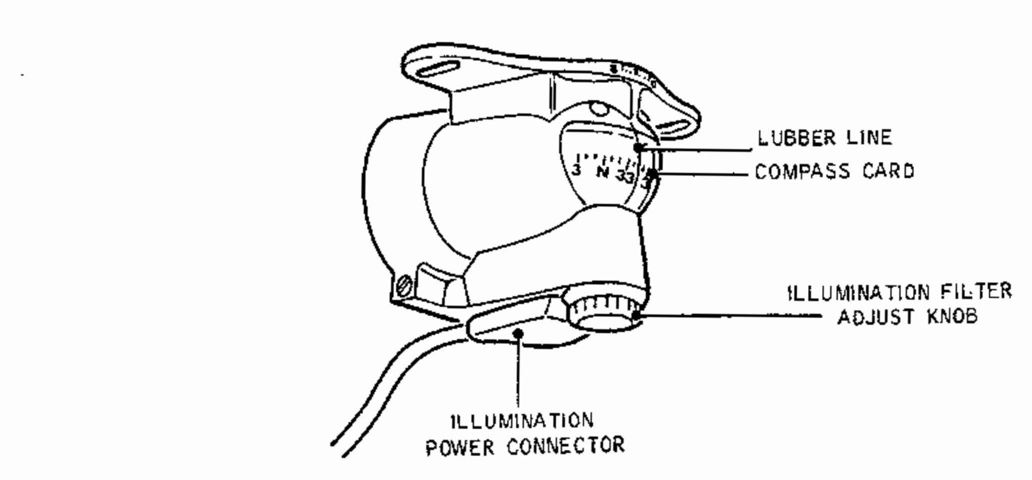
C. Standby Compass

The standby compass, which is an independent instrument, continuously supplies magnetic heading information which is read on amoving compass card. The heading indication is visible from the Captain and First Officer positions.

3. Attitude Information
(Ref. Fig. 002)

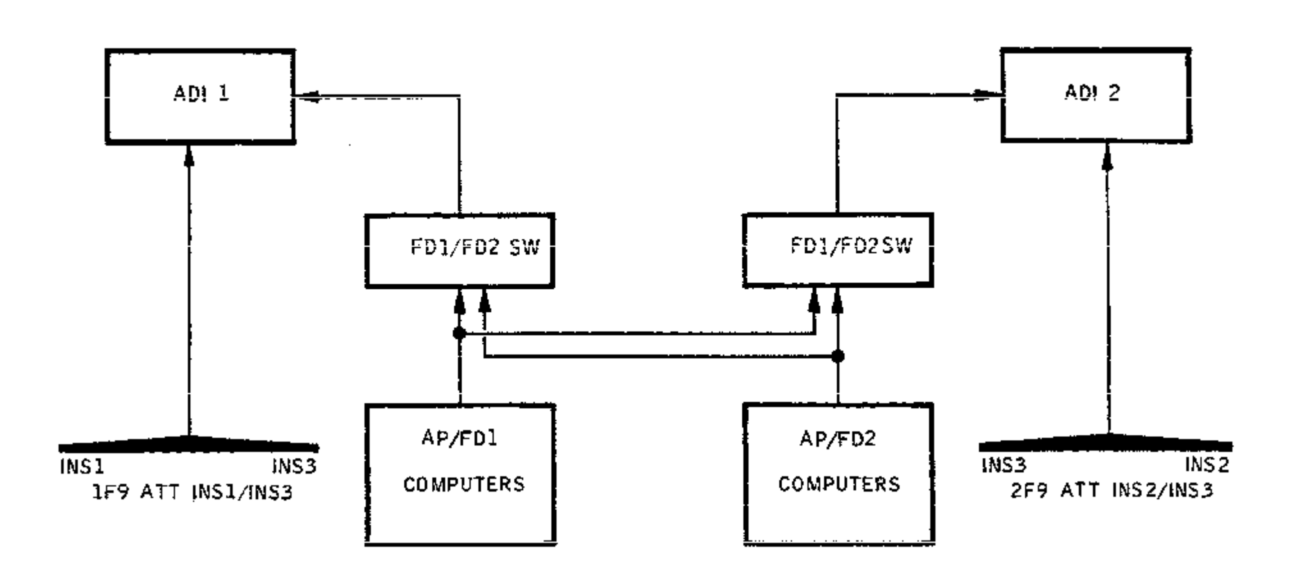
A. This information is normally presented on the attitude director indicators (ADIs).
Roll and pitch attitude information is sent from the INS via a switching unit. The ADI also indicates roll attitude

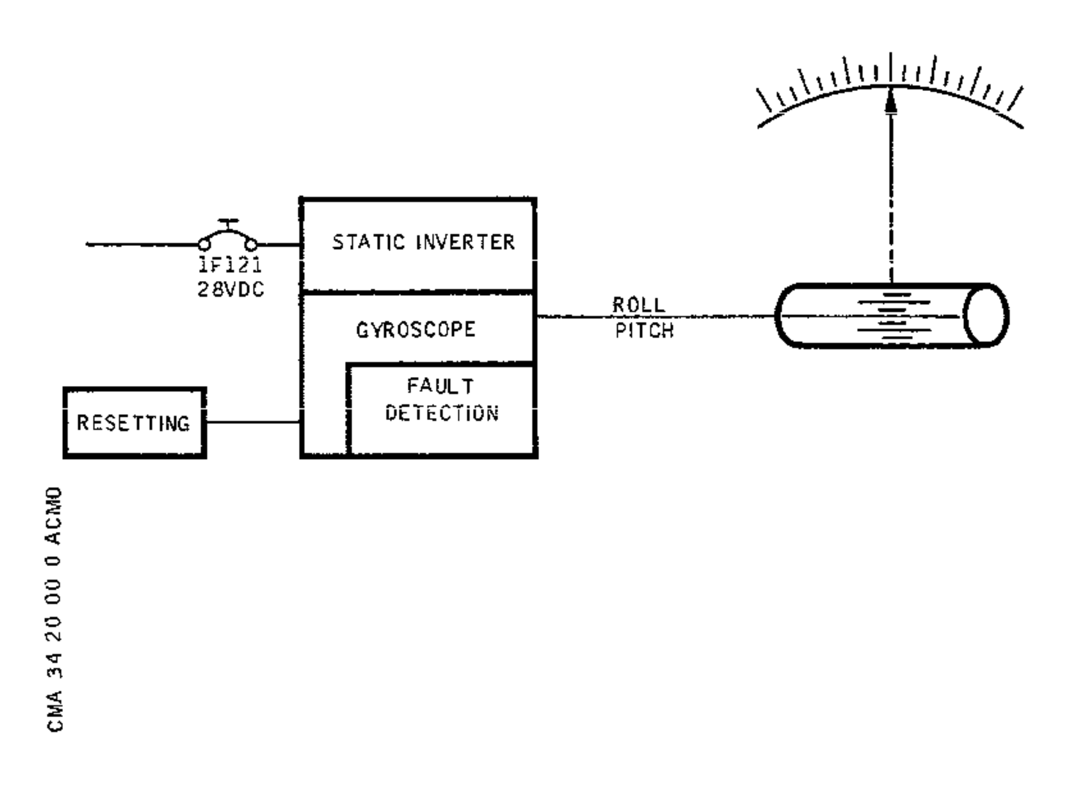




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Heading Information Block Diagram
and Standby Compass
Figure 001





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Attitude and Command Information and Standby
Horizon - Block Diagram
Figure 002

R

by means of a ball moving in a damping liquid. The ball moves in front of a zero marker.

B. Standby Horizon

R The standby horizon, an independent instrument, supplies
R a true vertical reference. It displays aircraft pitch and
R roll attitude on an indicator in which are incorporated
R a gyroscope and circuitry. The unit is supplied from a static inverter.

4. Acceleration Information

The angle of attack and acceleration indicator indicates vertical acceleration detected by a transducer and processed by a servo-loop.

5. Flight Director Instruments

R The ADIs provide the Captain and First Officer with INS atti-
R tude, yaw and command information, with position information
R with respect to an ILS beam and with low altitude information
R as a landing aid. The INS supplies pitch and roll attitude
R information, while the AP/FD lateral computers supply pitch
R and roll command information to the respective command bars,
R and yaw command information to the yaw (decrab) pointer. The
R pitch and roll command bar indications are referenced either to
R a selected track or to a radio beacon.
R The HSIs provide the Captain and First Officer with information
R of heading, drift, actual and desired track, track or heading
R selected, aircraft lateral position with respect to a LOC beam,
R a VOR radial or an INS track, aircraft position with respect
R to a GLIDE beam, distance TO GO to a waypoint on an INS track segment, and groundspeed.
R Selected track or heading is displayed on this indicator from
R the AFCS control unit (C1) ; the error signal thus determined
R is processed by a track heading selector unit, then sent to
R the AP/FD lateral computers.

END OF THIS SECTION

NEXT

COMPASS COUPLER - DESCRIPTION AND OPERATION

1. General

The compass coupler or MHRS (magnetic heading reference system) is designed to supply gyro - stabilized magnetic heading information or Grid heading information to peripheral systems. The system has five isolated outputs, distributed by synchro transmitter to the HSI and RMI indicators and the automatic
R pilot, and a clutched synchro transmitter output which provides
R a reference heading for the AFCS when heading hold is required.

R The system operates in one of two modes :
- MAG (slaved) mode or DG (free gyro) mode.

A. MAG Mode

In this mode, the inertial navigation system stabilizes the magnetic heading sensed by the flux valve. The system compensates for magnetic heading errors caused by disturbances :

- from hard iron
- from longitudinal or lateral accelerations.

B. DG Mode

In this mode, the MHRS output repeats the INS platform heading input, and corrects it for apparent drift due to earth rotation.

R A grid heading output is thus supplied, after initial alignment with a reference heading.

A superflag failure warning is supplied to the peripheral systems in the event of a system fault.

2. System Components

R The magnetic heading reference system comprises :

A. System units :

- One dual MHRS controller (F125)
R - Two compass coupler units (1F126 and 2F126)
- Two flux valves (1F127 and 2F127)
- Two flux valve compensators (1F129 and 2F129)
- Two COMP 1 - COMP 2 selector switches (1F133 and 2F133)
- One compass coupler 1 - 2 and 2 - 1 switching unit (F135)

R B. Associated elements belonging to other systems

- Two ATT/INS switching units (1F9 and 2F9)
- Two RAD/INS switching units (1F24 and 2F24)
R - Two VOR-RMI indicators (1R27 and 2R27)
R - Two ADF-RMI indicators (1R182 and 2R182)
- Two HSI indicators (1F22 and 2F22)
R - One dual control unit (1C)

R 3. Flux-Valve - SPERRY 4002342

A. Description

The flux valve is a sensor which converts magnetic information into electrical signals.
The flux-valve contains a pendulum sensor element immersed in a damping fluid. The system allows 30° of freedom in roll and pitch, but inhibits any rotation about its vertical axis. The sensor element consists of a transformer composed of a primary winding located at the centre of a three-branch core spaced at 120° intervals, the three
R secondary windings being wound on these branches.
An electrical connector connects the flux valve to the
R compass coupler.

(1) Mechanical Characteristics

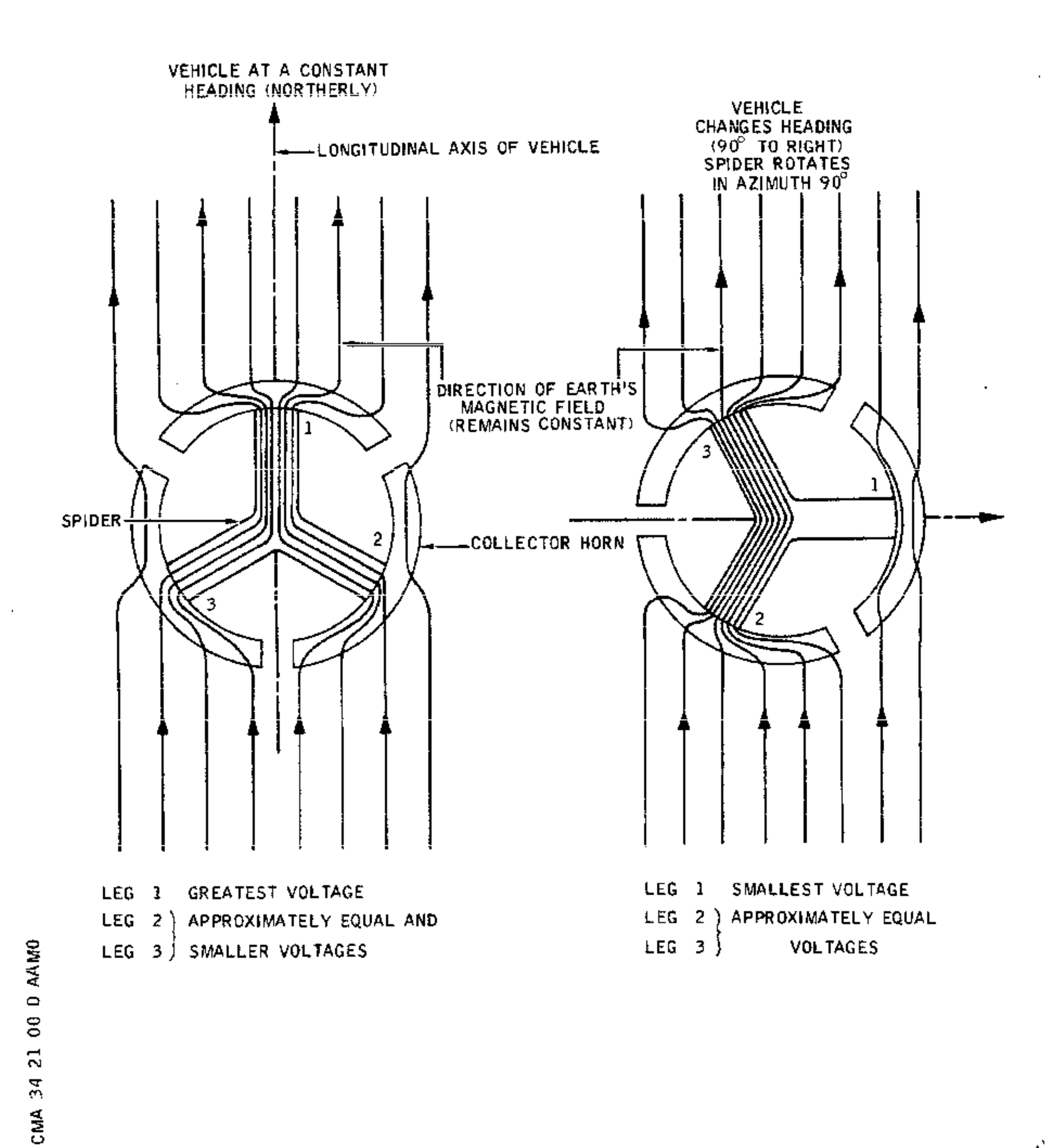
(a) Dimensions : Height 6.60 cm (2.6 in.)
Length 12.70 cm (5 in.)
Width 10.20 cm (4 in.)

(b) Weight : 0.900 Kg (2 pounds)

B. Operation (Ref. Fig. 001)

The flux valve senses the direction of the earth magnetic field and sends this information in the form of an electrical signal to a directional gyro or any other heading device.
It operates on the principle of complete saturation of one of the secondary windings.
R The 23.5V 400Hz applied to the primary winding generates a
R magnetic field which saturates the core of the secondary
R windings first in one direction and then in the opposite
R direction. This alternately attracts and repels the earths
R magnetic lines of force causing them to cut the secondary
R windings. This results in an 800 Hz secondary winding out-
R put voltage.

As the secondary windings are spaced at 120° intervals, the density of the lines of force induced in each branch

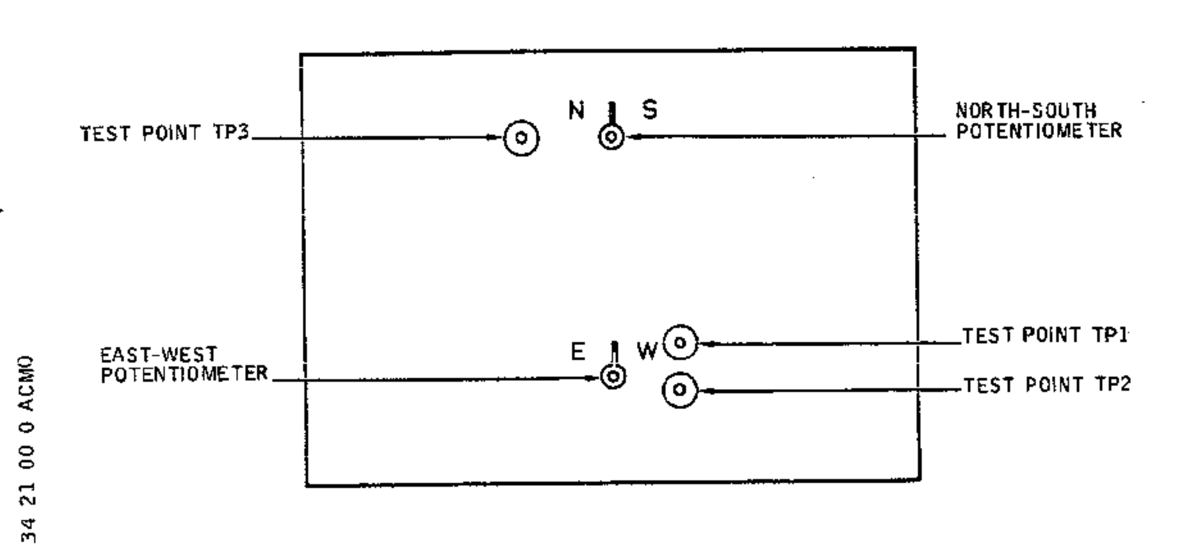


Flux Valve : Effects of Aircraft Heading on the Amplitude of Induced Currents
Figure 001

R depends on the position of the core with reference to the earth magnetic field. Thus, the 800 Hz output voltage of the flux valve corresponds to the direction of the earth magnetic field.

4. Compensator - Electronic, Remote, SPERRY 2575513

A. Description (Ref. Fig. 002)



Compensator : Front View
Figure 002

R The remote electronic compensator is a unit which provides
R correction for one cycle (North-South, East-West) error,
R adjustment is made by two potentiometers.

The assembly is contained in a rectangular box separate from the flux valve.

On the front panel are located :

- Two potentiometers identified N-S and E-W
- Three test points for adjustment checks (TP1 common, TP2 for the East-West axis and TP3 for the North-South

axis).

A supply connector is located on the rear panel for connection of the unit to the compass coupler.

(1) Mechanical Characteristics

(a) Dimensions : Height 6.35 cm (2.5 in.)
Length 6.70 cm (2.6 in.)
Width 8.90 cm (3.5 in.)

R (b) Weight : 0.130 Kg (0.3 pounds)

(2) Electrical Characteristics

Electrical supply : 23.5 VAC - 400 Hz ± 2 V supplied
R by the compass coupler.

B. Operation

The remote electronic compensator consists essentially of
R two regulated direct current generators the levels of which
R are adjusted by two potentiometers, one acting on the North-South axis, the other on the East-West axis. The flux valve output currents are sent directly to the compensator, and are taken from the output of the latter in a
R form directly usable by the compass coupler.

The compensation range of the two potentiometers E-W and N-S (tested with a flux valve in a standard horizontal magnetic field of 0.18 oersted) is as follows :

- One turn of the potentiometer screw equals an error correction of 4 to 6°
- Two turns of the potentiometer screw equals a correction of 9° or more.

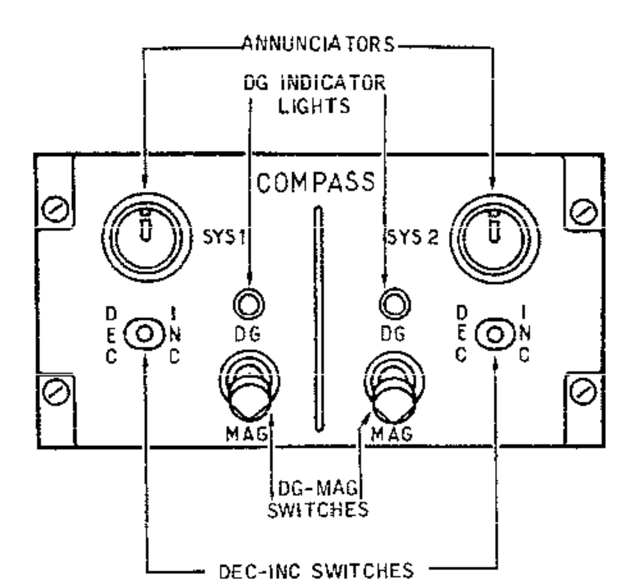
R 5. Controller - Dual, MHRS, SPERRY 2592801-902

A. General

R The dual compass controller is mounted on the flight engineer panel.
It provides remote control of operation, and information
R displays for the two compass couplers.

B. Description and Operation (Ref. Fig. 003)

The front panel on which the controls are mounted, is divided into two symmetrical sections. The left side for system 1, the right side for system 2.



CMA 34 21 00 0 AEMO

R MHRS Dual Controller : Front View
Figure 003

One side only will be described.

(1) On the front panel are mounted :

(a) An annunciator

This is a center-zero galvanometer which allows a check of the difference between aircraft magnetic heading and the compass coupler heading outputs, when the system is properly synchronized, the annunciator needle is centered in line with a fixed reference point. In case of an error, the needle will be to right or left of the reference point, thus giving the sense of the error. A positive error gives a deviation to the right of the reference point, a negative error gives a deviation to the left of the reference point. The annunciator operates only in MAG mode.

(b) A DEC-INC switch

R This switch permits the adjustment of a heading or the selection of a new heading. When the switch is in the central position, no correction is applied to the compass coupler unit. When the switch is placed in the DEC position, the heading value decreases, when it is placed at INC, the heading increases.

(c) A DG indicator light

This light illuminates to indicate that the system is operating in DG mode.

(d) A DG-MAG switch

R This switch permits selection of the mode of operation of the system :

In DG mode (Free gyro) :
R - The system follows the platform heading sup-
R plied by the INS
- DG indicator light illuminates
R - Annunciator is disabled

In MAG mode (Slaved)
R - The system provides gyro-stabilised magnetic
R heading.
R - The annunciators are operative

(2) On the rear panel, two supply connectors, one for system 1, the other for system 2, are used to connect
R the controllers to their respective compass couplers.
R
R 6. Compass Coupler - SPERRY 2592799-902

A. Description

R The compass coupler is a unit of the magnetic heading reference system (MHRS).

R The unit consists of four electronic assemblies a dual servo-mechanism and a power supply.

It is contained in a 3/8 ATR short case. Weight 5 Kg (11 lbs.). At the rear two connectors connect the unit to the MHRS and to the aircraft system.

(1) Electrical characteristics

- Power supply 115 VAC - 400 Hz ± 20 Hz
- Power consumption : 75 W max.

- Superflag : + 28 VDC valid heading output
  0 VDC invalid heading output

- Flux valve excitation : 23.5 VAC - 400 Hz

(2) Operation mode characteristics

(a) MAG mode

- Range of operation : 60° latitude north to 60° latitude south
- Normal slaving rate : 2° to 4° per minute.

(b) DG mode

- Manual heading adjustment rate : 300° to 500° per minute.

B. Operation (Ref. Fig.004 and 005)

The compass coupler provides stable and accurate magnetic
R heading information, processing the long term compensated
R flux valve signal with the short term stable signal from
the inertial navigation system platform (INS).

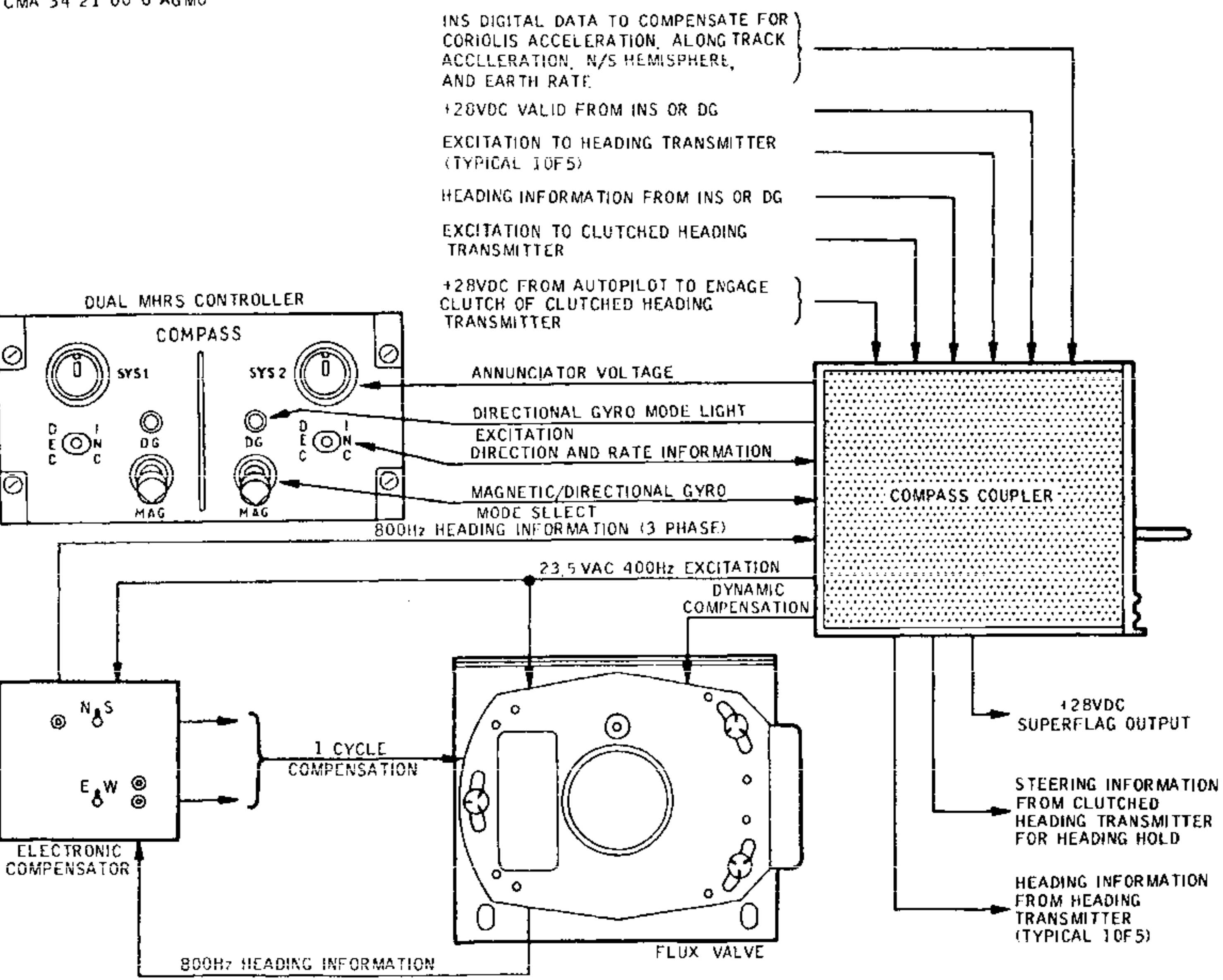
R The coupler has five separate heading outputs and one
R clutched synchro output, allowing the autopilot to be operated in the heading-hold mode.

R The coupler operates in two modes :

- MAG mode (slaved) in which the compensated flux valve signal is coupled with the directional reference signal
R from the INS system. In this mode, the coupler compensates flux valve magnetic heading errors caused by longitudinal and Coriolis accelerations.
- DG mode (free gyro) in which the output reflects the
R INS platform heading input correcting it for the apparent
R drift due to earth rotation.

(1) Servo mechanism loop

R The platform heading signal generated by the inertial platform (INS) is fed to the stator of differential transmitter B11, which drives its rotor to the input signal position, which is sent to the resolver stator B10 and to the INS heading data monitoring stage. The B10 rotor signal is applied to the servo-amplifier and to the servo CT null and continuity monitor. The heading signal is power amplified by the servo amplifier and fed to the servo motor which mechanically

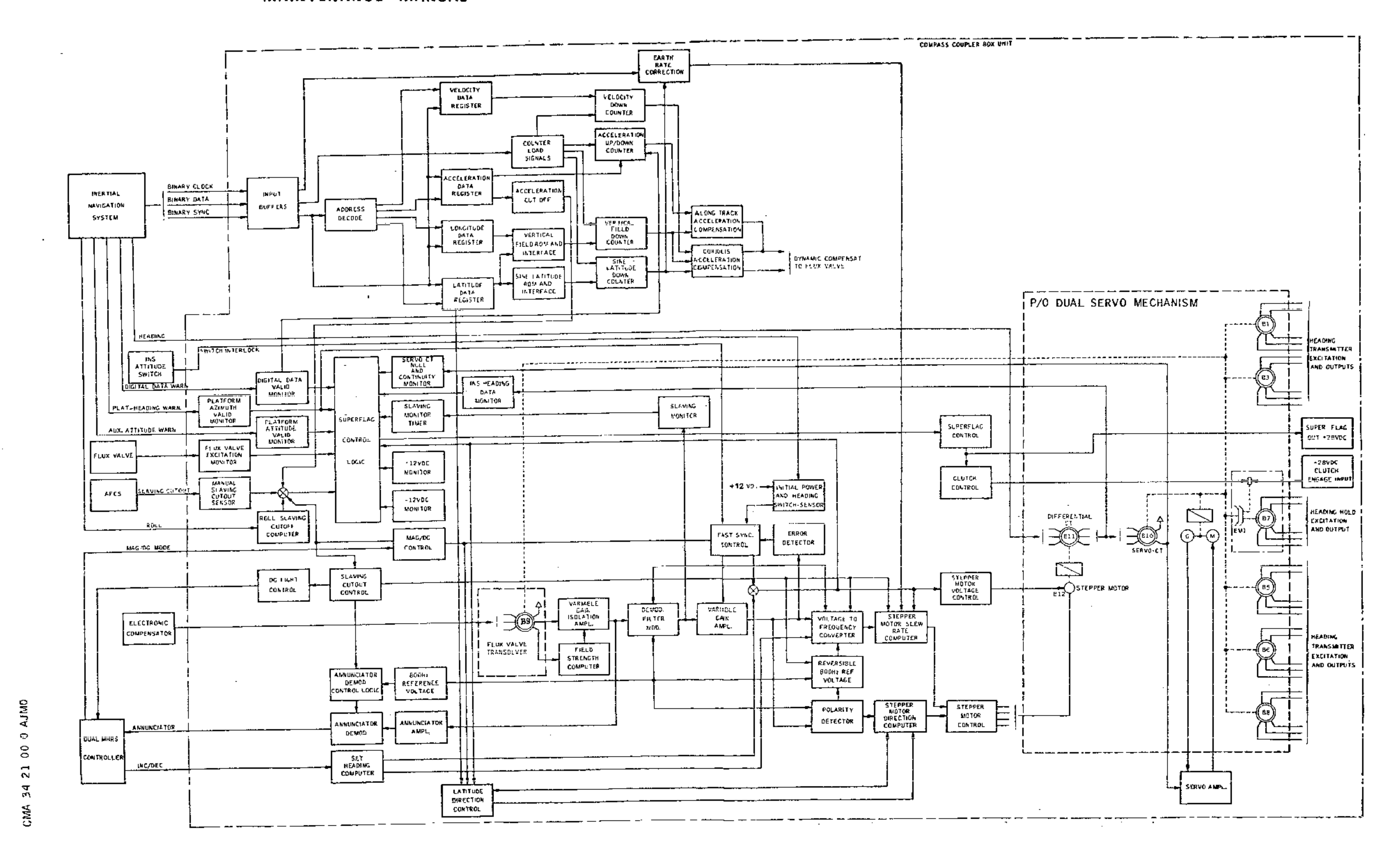


Compass Coupler : Information Distribution
Figure 004

R

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R

Compass Coupler : Operation Block Diagram
Figure 005

positions the rotor of B10, flux valve transolver B9 and the five synchro-transmitter B1, B3, B5, B6 and B8. The output of the rate generator is applied to the servo amplifier to stabilize the system. The motor will continue to drive until the rotor of B10 is at a null position.

Stepper motor B12 mechanically shifts differential control transmitter B11 rotor to set a new heading when the DEC-ING switch is operated.

Clutched control transmitter B7 provides a heading signal generated by the servo mechanism loop when clutch EM1 is engaged. When the clutch is disengaged B7 synchro is held at its null position. When a + 28 V d.c. heading hold command signal is applied, the clutch is engaged and B7 output indicates any changes in the heading shaft position.

The clutch is automatically disengaged if the super-flag control indicates a failure.

(2) DG mode

(a) Normal operation

On the controller, when the DG-MAG mode switch is in the DG position, heading information from the INS is fed to differential transmitter B11 which receives earth rate compensation information. This correction is derived from the 32 bit digital data from the latitude circuitry of the INS. The N-S hemisphere signal is fed to the latitude direction control which controls the direction of rotation of the stepper motor.

The earth rate correction stage applies a series of pulses, which are a sine function of geographical latitude, to the stepper motor control which drives the stepper motor according to the value of the correction signal. The stepper motor rotates differential transmitter B11.

The servo loop assembly is then aligned as described in 7. B. (1). The DG light on the controller illuminates on receipt of a command from the DG light control.

R (b) Set heading control

In order to change the heading, the INC-DEC
R switch on the controller is held in the desired position.

The generated signal is sent to the set heading computer, whose output signals are sent to the stepper motor control circuitry and to the superflag control logic.

The stepper motor control signals drive the stepper motor which mechanically positions the rotor of differential transmitter B11 which shifts the servo loop to the new heading. During this operation, the superflag control logic causes an invalid superflag output, and the clutch of synchro-transmitter B7 is disengaged.

(3) MAG mode

When the DG-MAG mode switch on the controller is in the MAG position, the compass-coupler receives two basic external inputs, these are :

- Magnetic field information sensed by the flux valve
- R Platform heading information from the inertial navigation system fed to the stator of differential transmitter B11.

(a) Normal Slaving

Magnetic field information sensed by the flux valve is fed to the stator of transolver B9. B9 rotor carries sine (null) and cosine (max) windings. The cosine winding supplies the field
R strength computer the output of which drives the variable gain isolation amplifer, which in turn processes the sine signal (heading error). The variable-gain isolation amplifier whose output is constant regardless of field strength
R variations feeds the demodulation-filter
R -modulator and the annunciator amplifier.
The 800 Hz heading error signal amplified by the annunciator amplifier is sent to the annunciator demodulator, which receives a reference 800 Hz signal. After demodulation the error-signal is sent to the annunciator in the controller which indicates the sense of the error.
R The demodulation-filter-modulator suppresses the

effects of low frequency mechanical oscillations generated in the flux valve by aircraft vibrations and applies the error signal to the variable-gain amplifier and the slaving monitor. The variable-gain amplifier changes gain during fast synchronization to prevent oscillations, and its output is then applied to the voltage-to-frequency converter, the polarity detector and error detector. The voltage-to-frequency converter sends an output pulse train with a frequency proportional to the magnetic heading error to the stepper motor slew rate computer, which sends operation output signals to the stepper motor control. The polarity detector determines the phase of the error signal and applies a rotation sense logic signal through the stepper motor directional computer to the stepper motor control.
The stepper motor control combines stepping rate and direction signals, supplying stepper motor B12 with a control signal. The motor turns in accordance with the rate and direction signals received, mechanically positioning the rotor of differential transmitter B11, which slaves the servo-loop, which aligns with aircraft magnetic heading.
The normal slaving rate is approximately 2 to 4° per minute.

(b) Fast synchronization

Fast synchronization is a means of rapidly aligning the servo-loop with aircraft magnetic heading. The system will be aligned with this heading within 30 seconds of fast synchronization initiation.

Fast synchronization mode is initiated when :

R - The MAG-DG switch on the controller is moved
R from the DG to the MAG position.
- The magnetic heading error is greater than 2°
- The system is not in slaving cutout (See paragraph 7. (3) (d)).

The stages which intitiate the operation of fast synchronization are as follows :

(b1) Error detector

The error detector input is a magnetic

heading error from the variable-gain amplifier of a value greater than 2°.

(b2) MAG-DG input

R When the switch on the controller is placed in the MAG position a signal is sent through the MAG-DG control to an input of the fast synchronization control.

(b3) Initial power sensor

The initial power sensor applies a signal to an input of the fast synchronization control for approximately 5 seconds. After this period, fast synchronization is dependent on the error detector output.
R The fast synchronization power cycle is
R repeated every two minutes.

(b4) Heading switching sensor

The heading switching sensor is actuated by a momentary opening of the INS switching circuit. This stage sends a voltage to the fast synchronization control for about 5 seconds. After this period, fast synchronization is transferred to the error detector.

When the system is operating in this mode, fast synchronization control causes :

- A negative filtering voltage to the modulator-filter-demodulator
- A reduction in gain of the variable-gain amplifier
- An increase in the rate of the voltage frequency converter causing an increase in the stepping rate of the stepper motor
- The superflag output becomes invalid
- The stepper motor excitation voltage is increased.

(c) Manual synchronization

The system can be manually synchronized by the use of the INC-DEC switch on the controller This operation is effected in conjunction with the annunciator indication, the INC-DEC switch

being held in the opposite sense to the annunciator deviation.
The signal produced by the switch operation
R acts as described in 6. B. (2) (b).

(d) Slaving cutout

The slaving cutout control switches the system to DG operation upon receipt of :

- A longitudinal acceleration signal greater than 0.078 g
- A roll signal greater than 6°
- R A DG command from the MAG-DG switch on the controller
- A cutout signal from the automatic pilot.

When the system is in slaving cutout, the following will occur :

- On the MHRS controller, the annunciator is disabled and the DG indicator light illuminates
- The fast synchronization control, 800 Hz reference voltage, voltage to frequency converter, slaving monitor and flux valve excitation monitor are all disabled
- The stepper motor slew rate computer goes into operation in conjunction with the voltage to frequency converter to make earth rotation rate corrections.

(e) Compensation

Errors due to the aircraft magnetic field longitudinal accelerations and Coriolis acceleration are compensated by passing direct currents through the flux valve sensing element coils, producing opposing magnetic fields.

(e1) Electronic compensation

This correction is made by the flux valve electronic compensator.

(e2) Longitudinal acceleration and Coriolis compensation

These compensation signals are developed from the 32-bit digital data from the INS, representing latitude, longitude, aircraft speed and acceleration.

This information is applied to the address decoder, which decodes the data words and loads the applicable data register.
The data registers convert the series data and send it to the memory, then to the counters. The counter outputs are pulses whose periods are proportional to the amplitude of the INS inputs. These pulses control the compensation stages which produce dynamic flux valve compensation according to vertical field intensity, aircraft speed and acceleration at the aircraft position.

(4) Superflag control and monitoring

(a) Superflag control

Superflag control receives valid or invalid information from superflag control logic, which is constantly monitored. Superflag control provides :

- A + 28 VDC output when the heading outputs are valid, and 0 VDC when the outputs are invalid
R - A ground path for the clutch control of
R synchro-transmitter B7. This ground path prevents the engagement of B7 clutch when the superflag output is invalid, or automatically disengages it if it has been previously engaged.

(b) Monitoring

Superflag logic control receives valid or invalid signal information from the monitoring stages. When a failure is detected by the monitoring a signal is sent to the superflag control logic which gives a heading information invalid signal.

The superflag control output will be invalid during any of the following conditions :

(b1) DG mode :

- Loss of INS heading signal or differential transmitter B11 not energized
- An error in resolver B10 rotor, greater
R than three degrees, or open rotor winding
R in the servo

- Loss of digital data valid signal from the INS
- Loss of platform attitude valid signal
- Loss of platform azimuth valid signal
- Loss of + or - 12 VDC system power
- INC-DEC switch on the controller not in central position.

(b2) MAG mode

In addition to the monitoring used in DG mode, the two following are used :

- Loss of flux valve excitation supply
- Slaving monitor and timer. When an error of approximately 10° is present in the slaving loop at the variable-gain amplifier input, it is detected by the slaving monitor which activates the slaving monitor timer. If this error is present for more than six minutes (timer time delay) an invalid signal is applied to the superflag control logic stage.

7. Operation (Ref. Fig. 006)

R A. Information Necessary for Operation

R In order to supply the stabilized magnetic heading to the various systems using this information, the compass coupler receives :

(1) Two heading reference signals :

- A magnetic reference signal sensed by the flux valve and corrected by the electronic compensator
R - A reference platform heading signal from the inertial navigation system.

(2) From the inertial navigation system :

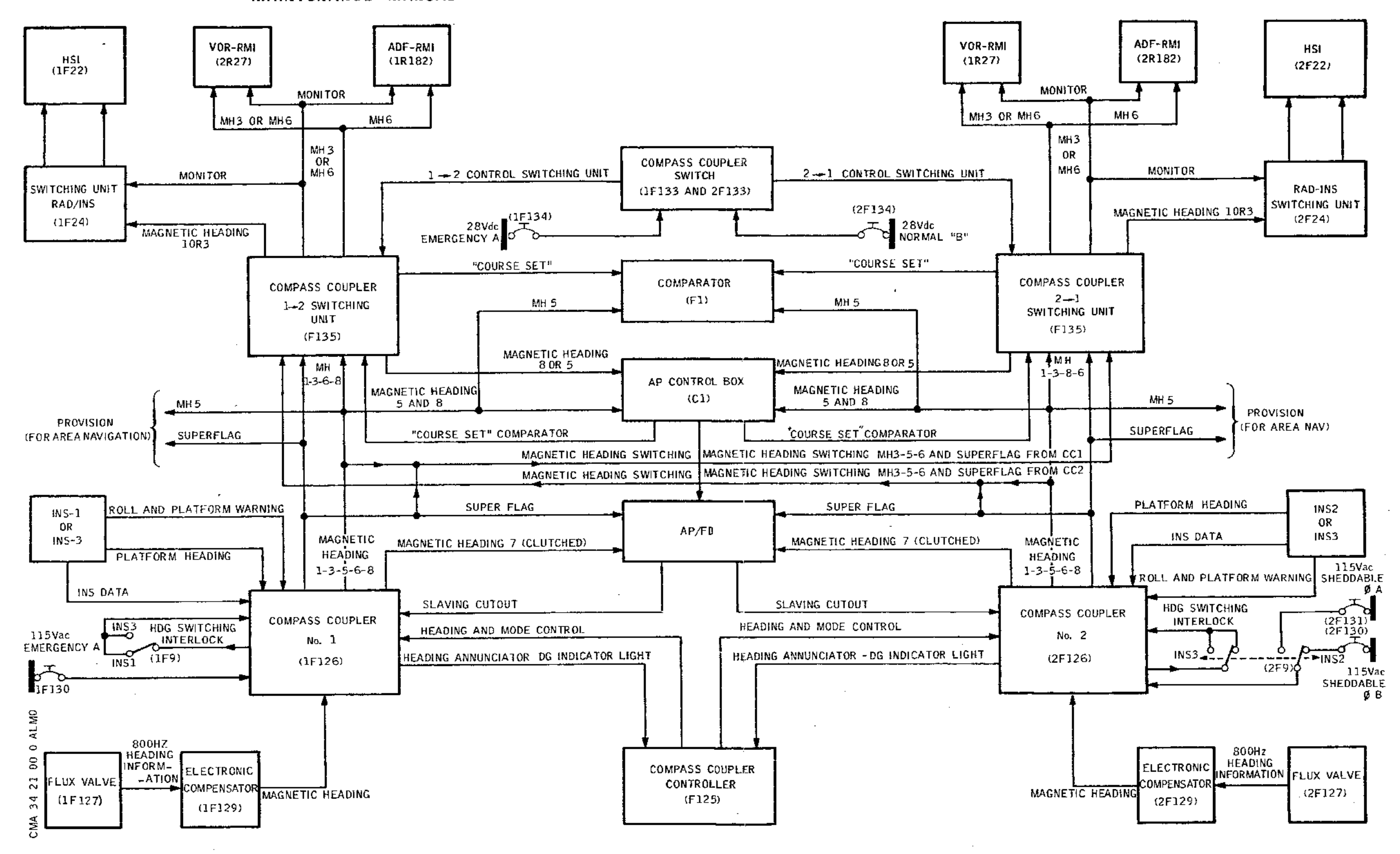
- A 32 bit data signal representing geographical latitude and longitude, speed and acceleration of the aircraft
R - Roll data
R - Attitude, platform heading and digital data failure
R warning

(3) From the automatic pilot and flight director :

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Compass Coupler : System Operation Block Diagram
Figure 006

R - Slaving cutout signal

(4) From the MHRS controller :

- Heading selection information
- Mode of operation selected.

R B. Modes of Operation

When the compass coupler and the various peripheral systems are energized, stabilized heading information is available for distribution to the user systems in two operation modes selected by the MHRS controller.

- DG mode (free gyro)
- MAG mode (slaved).

(1) DG Mode

When the MAG-DG switch on the MHRS controller is R placed in the DG position, the platform heading signal R generated by the INS only is used.

In this mode, the system will follow all the changes R in platform heading information from the INS. Correc- R tion for the effect of the earth rate is applied in R the form of 32-bit data words, which correct the plat- R form heading by a series of pulses which are a sine function of the geographic latitude. The output is corrected heading data, distributed by five synchro- R transmitters (MH1, 3, 5, 6 and 8) to the user systems.

R A sixth heading output (MH7), used by the automatic pilot, is only applied on receipt of an engage clutch command from the latter to the clutched synchro-transmitter. The heading output can be set to a new value by using the automatic return to zero switch DEC-INC on the MHRS controller. The DEC position decreases the heading, INC position increases the heading. When the desired heading value is obtained, the switch is released.
When the set heading control is being used, heading information is not available to the automatic pilot, the clutched synchro-transmitter being disengaged.
In this operation mode, the DG indicator light on the MHRS controller is illuminated and the inscription MAG is visible in the HSI upper window.

(2) MAG mode

When the MAG-DG toggle switch on the MHRS controller is placed in the MAG position, the compass coupler receives :

- Earth magnetic field information sensed by the flux valve
- Directional reference information supplied by the INS.

The magnetic field information sensed by the flux valve is corrected by the electronic compensator, by the 32-bit data and by the roll information from the INS.
This corrected magnetic field information is fed to a differential transmitter, which is fed also with directional reference information from the INS.
The heading information obtained at the output of the differential transmitter is fed to a servo-motor which positions the output synchro-transmitters (MH1, MH3, MH5, MH6, MH8) to the aircraft magnetic heading. The sixth heading information output (MH7), used by the automatic pilot, will only be applied when the synchro-transmitter clutch is engaged.
An annunciator system indicates the error between the magnetic field information sensed by the flux valve and the magnetic heading output of the system.

With no error, the annunciator needle will be positioned opposite a fixed reference point. (However, the needle will oscillate indicating that the flux valve is operating).
In the case of a positive direction error, the needle will be positioned to the right of the reference point, in case of a negative direction error thhe needle will be positioned to the left of the reference point.
The error will be corrected by normal slaving, fast synchronization or by manual operation.
In this mode, the MAG inscription is visible in the upper window of the HSI.

(a) Normal slaving

The correction of heading variations is made by normal slaving at a rate of 2 to 4° per minute, when the servomotor is at a balanced position, the output synchro-transmitter position represents the aircraft magnetic heading.

(b) Fast synchronization

Fast synchronization is the means of rapidly aligning the servomotor loop to a magnetic heading when the error is greater them 2°. Fast synchronization will not take place if slaving cutout is in operation.

(c) Manual synchronization

As in DG mode, the system can be slaved to a new heading by using the INC-DEC switch on the MHRS controller.
To correct the error reading on the annunciator, the switch is placed in the position opposite to the direction of the annunciator needle deviation.

(d) Slaving cutout

In this configuration, slaving to the flux valve signal is cutout and the system operates in DG mode. Slaving cutout will come into operation if one of the following conditions is met :

R - If the longitudinal acceleration signal exceeds 0.078 g
- If the roll exceeds six degrees
- If the MAG/DG switch on the MHRS controller is in the DG position.

C. Magnetic Heading and Superflag Distribution

Each compass coupler supplies five isolated magnetic
R heading outputs (MH1 - MH3 - MH5 - MH6 - MH8), one clutched
R synchro-transmitter output, (MH7) and superflag information.
R The MH1, MH3, MH6, MH8 and superflag outputs are fed to the compass coupler 1 - 2 and 2 - 1 switching units.

R The MH3, MH5, MH6 and superflag outputs from compass coupler 2 are fed to the 1 - 2 switching unit, whilst the
R MH3, MH5, MH6 and superflag outputs from compass coupler 1 are fed to the 2 - 1 switching units.

According to the COMP1 - COMP2 switch position (Captain and First Officer instrument panel) the compass coupler switching unit distributes the outputs to the required units.

R MH5 output is fed :

R - Directly to the autopilot control unit, the compa-

rator and the area navigation system assembly. (full-provision)

R - Indirectly to the autopilot control unit through the 1 - 2 and 2 - 1 switching units.

R MH7 output (clutched is fed to the autopilot/flight director
R (AP/FD) when the synchro-transmitter clutch is engaged by
R selecting heading hold mode.

D. Switching (Ref. Fig. 007)

R (1) INS Heading switching interlock

When the ATT-INS switch unit (1F9 or 2F9) is driven
R from INS1 to INS3 or INS 2 to INS3 positions, the compass coupler goes into fast synchronization for approximately 5 seconds. After this period, signals from the selected INS are distributed normally to the compass coupler.

(2) Magnetic heading and superflag switching

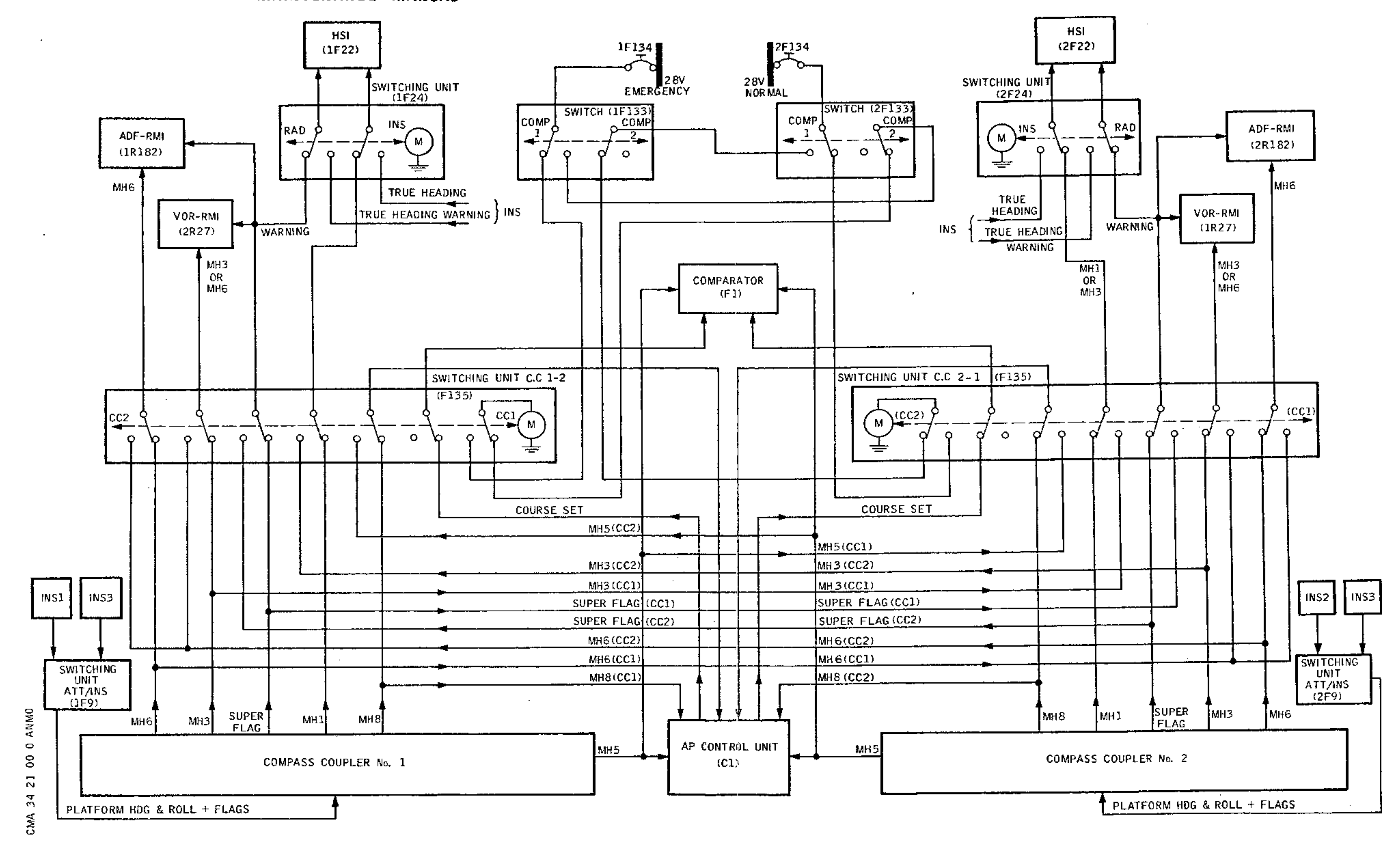
R By means of the Captain and First Officer COMP1 -
R COMP2 switches it is possible to supply either compass coupler 1 or compass coupler 2 information to the Captain and First Officer systems.

The possible switching arrangements are given in the table below :

Switch positions		Switching unit	Switching unit
captain	First Officer	1-2 to :	2-1 to :
COMP1	COMP2	Compass coupler 1	Compass coupler 2
COMP1	COMP1	Compass coupler 1	Compass coupler 1
COMP2	COMP2	Compass coupler 2	Compass coupler 2
COMP1	COMP2	Compass coupler 1	Compass coupler 2

(a) Captain switch in COMP1 and First Officer switch in COMP2 positions.

R When the COMP1-COMP2 selector switches are set
R to these positions, the 1-2 switching must con-
R nects the No.1 user systems to compass coupler 1
R while the 2-1 switching unit connects the No.2
R user systems to compass coupler 2.



Compass Coupler : Switching
Figure 007

The distribution of information is shown in the table below :

	Instruments	Compass coupler 1		Compass coupler 2	
		Magnetic heading	warning	Magnetic heading	warning
R	Captain HSI	MH1	Yes	-	-
R	Captain RMI-ADF	MH6	Yes	-	-
R	First Officer RMI-VOR	MH3	Yes	-	-
R R R	A.P Control unit (Capt side)	MH8 MH5 and MH8 direct	-	-	-
R	Comparator (capt side)	Course set MH5 direct	-	-	-
R	First Officer HSI	-	-	MH6	Yes
R	First Officer RMI-ADF	-		MH6	Yes
R	Captain RMI-VOR	-	-	MH3	Yes
R R R	AP control unit (F/O side)	= -	= -	MH8 MH5 and MH8 direct	=
R	Comparator (F/O side)	-	-	Course set MH5 direct	

(b) Captain and First Officer switches in COMP1 position.

R
R

When the Captain and First Officer switches COMP1-COMP2 are placed at COMP1, switching unit 1 - 2 connects the heading and superflag outputs from compass coupler 1,whilst switching unit 2 - 1 also connects the heading and superflag switchable information outputs from compass coupler 1. The instruments using compass coupler 1 are supplied directly ; the instruments normally

using compass coupler 2 are supplied by the switchable outputs from compass coupler 1.
The distribution of information is shown in the table below :

	Instruments	Compass coupler 1		Compass coupler 2	
		Magnetic heading	warning	Magnetic heading	warning
R	Captain HSI	MH1	Yes	-	-
R	Captain RMI-ADF	MH6	Yes	-	-
R	First Officer RMI-VOR	MH3	Yes	-	-
R R R	AP control unit (Capt side)	MH8 MH5-MH8 direct	-	-	-
R	Comparator (Capt side)	Course set MH5 direct	-	-	-
R	First Officer HSI	MH3	Yes	-	-
R	First Officer RMI-ADF	MH6	Yes	-	-
R	Captain RMI-VOR	MH6	Yes	-	-
R R R	AP control unit (F/O side)	MH5	-	MH5-MH8 direct	-
R R	Comparator (F/O side)	-	-	MH5 direct	-

(c) Captain and First Officer switches in COMP2 positions.

Results as for D. (2) (c) but the information is fed directly or switchable from compass coupler 2.

The distribution of information is shown in the table below :

	Instruments	Compass coupler 1		Compass coupler 2	
		Magnetic heading	warning	Magnetic heading	warning
R	Captain HSI	-	-	MH3	Yes
R	Captain RMI-ADF	-	-	MH6	Yes
R	First Officer RMI-VOR	-	-	MH6	Yes
R R R	AP control unit (Capt side)	MH5 and MH8	-	MH5	-
R R	Comparator (Capt side)	MH5 direct	-	-	-
R	First Officer HSI	-	-	MH1	Yes
R	First Officer RMI-ADF	-	-	MH6	Yes
R	Captain RMI-VOR	-	-	MH3	Yes
R R	AP control unit (F/O side)	-	-	MH8 MH5 and MH8	-
R	Comparator (F/O side)	-	-	Course set MH5 direct	-

(d) Captain switch in COMP1 position, First Officer switch in COMP2 position.

Results identical with D. (2) (a).

(3) Inertial navigation system - compass coupler switching.

When the RAD-INS switching unit (1F24 or 2F24) is driven to the RAD position, magnetic heading and compass coupler warning information are sent to the HSI.
When the RAD-INS switching unit is driven to the INS position, heading and warning information is distri-

buted by the inertial navigation systems.

E. Warning

R The compass coupler provides a 28VDC superflag signal when the heading outputs are valid.
R If a fault occcurs in operation, the value of this signal
R goes to 0VDC.

R The monitoring which makes the heading outputs invalid
R check :

- Compass coupler power supply
- Flux valve excitation
- Slaving and timer
- INS digital data signal
- Inertial navigation system heading information
- Inertial navigation system attitude information.

Superflag control is applied both in the DG and MAG modes.

The superflag signal is sent :

- R To the autopilot/flight director (AP/FD) determining the validity of the applied heading information
- R To the HSI systems in order to determine the validity of the heading information
- To the RMI systems in order to determine the validity of the heading information
- For the area navigation system. (Full provision).

F. Associated Instruments

Magnetic heading and superflag information is sent to instruments on the Captain and First Officer instrument panels, these are :

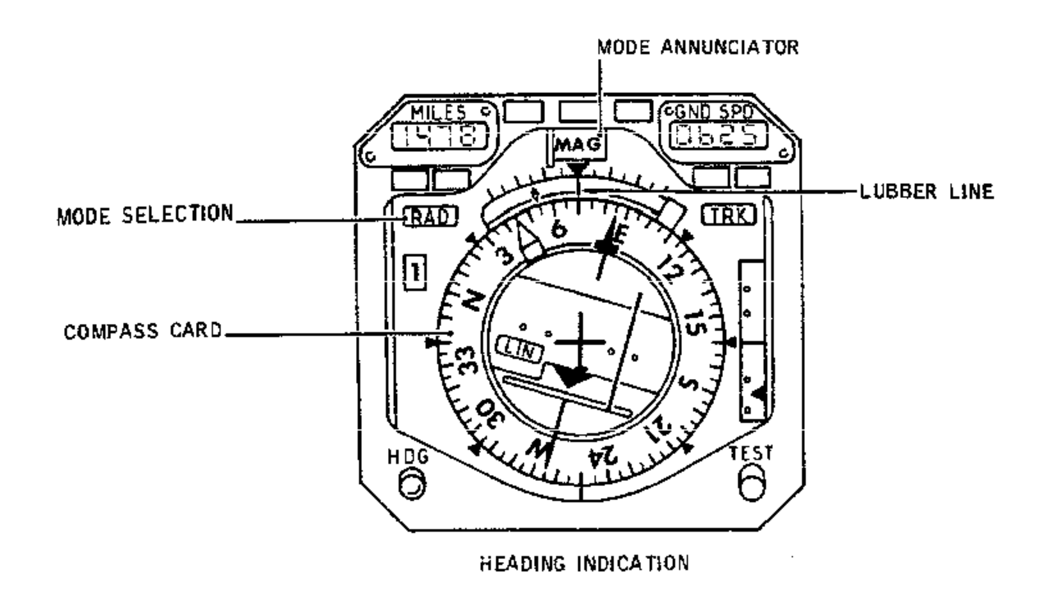
- The HSI units (Horizontal situation indicator)
- The RMI units (Radio-magnetic indicator).

(1) HSI (Ref. Fig. 008)

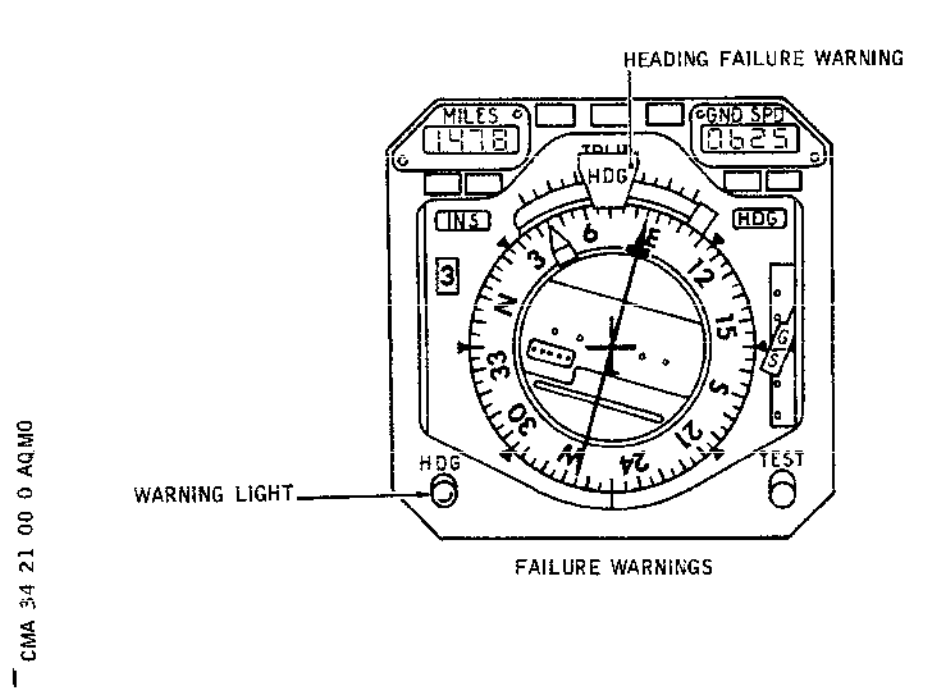
(a) Heading indications

R Indications of true heading in INS mode or of magnetic heading in RAD mode are made on a compass card graduated from 0° to 360° which moves before a fixed reference line, or lubber line.

INS or RAD mode selection is made by the use of
R switches (1F25 or 2F25) located on the Captain



HEADING INDICATION



FAILURE WARNINGS

CMA 34 21 00 0 AQMO

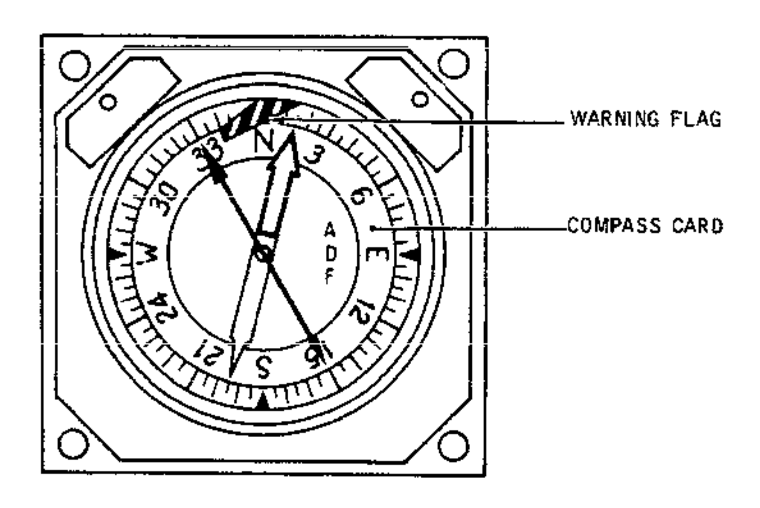
HSI : Heading Indication Configuration/
Configuration with Warning Visible
Figure 008

or First Officer instrument panels ; an annunciator to the upper left of the face displays the selected mode.
If the selector is on RAD, the inscription MAG appears above the lubber line, if INS is selected, the inscription TRUE appears.

(b) Failure warning

R A red flag, marked HDG, appears if the super-
R flag signal is at OVDC (heading information invalid). It masks the lubber line making reading of the heading impossible. An HDG warning light illuminates when a discrepancy occurs between the heading indications of the two HSI units.

R (2) ADF-RMI (Ref. Fig. 009)



CMA 34 21 00 0 ASM0

ADF-RMI - Front View
R Figure 009

(a) Heading indications

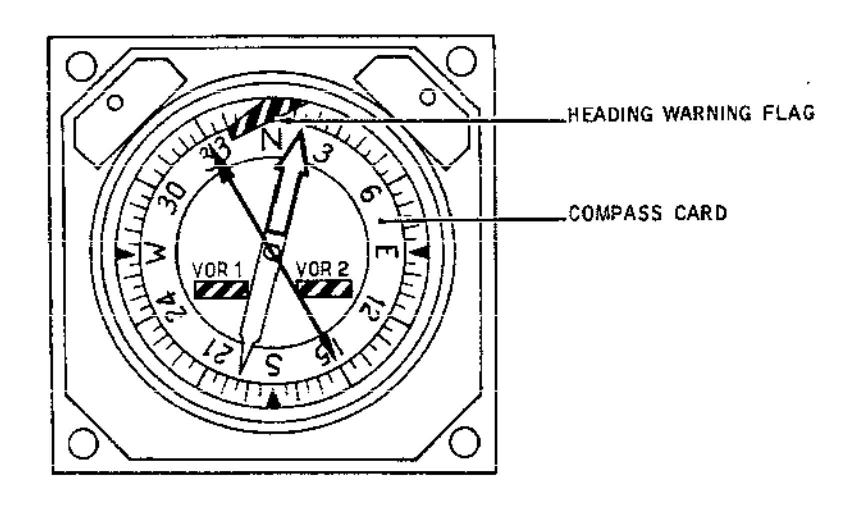
Indication of magnetic heading is made on a

compass card graduated from 0° to 360° which moves behind a lubber line located on the upper part of the indicator.

(b) Warning flag

R A striped red warning flag appears if the
R superflag signal is at OVDC (heading information invalid or a failure of instrument power).
In all cases the flag masks the lubber line, making reading of the heading impossible.

R (3) VOR-RMI (Ref. Fig. 010)



CMA 34 21 00 0 AUMO

VOR-RMI - Front View
R Figure 010

(a) Heading Indications

Magnetic heading indication is made on a compass card graduated from 0° to 360° which moves behind a lubber line located an the upper part of the indicator.

(b) Warning flag

R A striped red flag appears if the superflag
R signal is at OVDC (heading information invalid or a failure of instrument power).
In all cases, the flag masks the lubber line, making reading of the heading impossible.

COMPASS COUPLER - TROUBLE SHOOTING

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of the trouble-shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary.
If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Prepare

A. Switching. State of systems before start-up (Ref. 34-21-00, Adjustment/Test).

B. On First Officer instrument panel place COMP1/COMP2 switch in COMP1 position.

C. Trip the following circuit breaker :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER 2 NORM SUP	13-216	2F 130	D15

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3. Trouble Shooting

```
*****************************************************
* On HSI, RMI/VOR and RMI/ADF indicators check that *
* COMPASS flags are not visible.                    *
*****************************************************
    ||    |
    ||    |          ----------------------------------------------------
    ||    |         | COMPASS flags remain visible on indicators.        |
    ||   NOT OK----| Ref. Chart 101.                                    |
    ||    |          ----------------------------------------------------
    ||    |
    ||    |          ----------------------------------------------------
    ||    |         | COMPASS flags on Captain HSI and RMI/ADF and       |
    ||   NOT OK----| First Officer RMI/VOR remain visible.              |
    ||    |         | Ref. Chart 102                                     |
    ||    |          ----------------------------------------------------
    ||    |
    ||    |          ----------------------------------------------------
    ||    |         | COMPASS flags on First Officer HSI and RMI/ADF     |
    ||   NOT OK----| and Captain RMI/VOR remain visible.                |
    ||    |         | Ref. Chart 103                                     |
    ||    |          ----------------------------------------------------
    ||    |
    ||    |          ----------------------------------------------------
    ||    |         | COMPASS flag on Captain HSI remains visible.       |
    ||   NOT OK----| Ref, Chart 104                                     |
    ||    |          ----------------------------------------------------
    ||    |
    ||    |          ----------------------------------------------------
    ||    |         | COMPASS flag on Captain RMI/ADF remains visible    |
    ||   NOT OK----| Ref. Chart 105                                     |
    ||    |          ----------------------------------------------------
    ||    |
    ||    |          ----------------------------------------------------
    ||    |         | COMPASS flag on First Officer RMI/VOR remains      |
    ||    |         | visible.                                           |
    ||   NOT OK----| Ref. Chart 106                                     |
    ||               ----------------------------------------------------
    OK
    ||
*****************************************************
* Place First Officer COMP1/COMP2 switch in COMP2   *
* position. Check that flags reappear on First Off- *
* icer HSI and RMI/ADF and Captain RMI/VOR IF       *
*****************************************************
    ||    |
    ||    |          ----------------------------------------------------
    ||   NOT OK----| Flags remain visible. Ref. Chart 107               |
    ||               ----------------------------------------------------
```

```
    ||
    OK
    ||
*****************************************************
* Set circuit breaker 2F130 [1]. Check that flags   *
* disappear on First Officer HSI and RMI/ADF and    *
* Captain RMI/VOR.                                  *
*****************************************************
    ||    |
    ||    |     ----------------------------------------------------
    ||    |     | COMPASS flags remain visible on First Officer    |
    ||    |     | ASI and RMI/ADF and Captain RMI/VOR.             |
    ||    NOT OK----| Ref. Chart 103                               |
    ||          ----------------------------------------------------
    OK
    ||
*****************************************************
* Check that magnetic heading is identical within 1°*
* on Captain HSI and RMI/ADF and First Officer RMI/ *
* VOR. (First Officer HSI and RMI/ADF and Captain   *
* RMI/VOR).   IF                                    *
*****************************************************
    ||    |
    ||    |     ----------------------------------------------------
    ||    |     | Magnetic heading incorrect on HSI                |
    ||    NOT OK----| Ref. Chart 104                               |
    ||    |     ----------------------------------------------------
    ||    |
    ||    |     ----------------------------------------------------
    ||    |     | Magnetic heading incorrect on RMI/ADF            |
    ||    NOT OK----| Ref, Chart 105                               |
    ||    |     ----------------------------------------------------
    ||    |
    ||    |     ----------------------------------------------------
    ||    |     | Magnetic heading incorrect on RMI/VOR            |
    ||    NOT OK----| Ref. Chart 106                               |
    ||    |     ----------------------------------------------------
    OK    |
    ||    |
*****************************************************
* Check that COMPASS COUPLER 1 and COMPASS COUPLER 2*
* magnetic headings are identical   IF              *
*****************************************************
    ||    |
    ||    |     ----------------------------------------------------
    ||    |     | COMPASS COUPLER 1 and 2 headings are not ident-|
    ||    NOT OK----| ical.                                        |
    ||    |     | Ref. Chart 108                                   |
                ----------------------------------------------------
```

```
****************************************************
* Place DG/MAG No.1 (No.2) switch on MHRS dual cont-*
* roller in DG position. LH (RH) DG red warning     *
* light comes on. Place and hold DEC/INC No.1 (No.2)*
* switch in DEC position and select deviation of    *
* approximately 6°. On Captain HSI and RMI/ADF and  *
* First Officer RMI/VOR (First Officer HS1 and RMI/ *
* ADF and Captain RMI/VOR) heading decreases, head- *
* ing dials turn clockwise, COMPASS flag appears    *
* for a variation greater than 2°.   If             *
****************************************************
   ||    |
   ||    |        -------------------------------------------------
   ||    |       | DG red warning light does not illuminate. Head-|
   ||    |       | ing dials are not fixed when switch is released|
   ||   NOT OK----| Ref. Chart 112                                 |
   ||            | Flag does not appear. Heading dials do not turn|
   ||            | Ref. Chart 109                                 |
   ||             -------------------------------------------------
   OK
   ||
****************************************************
* Release DEC/INC No.1 (2) switch. Place DG/MAG No.1*
* (2) switch in MAG position. Check that indicator  *
* heading dials concerned return to the heading,    *
* that COMPASS flag disappears, on MHRS dual cont-  *
* roller that synchronization indicator pointer ret-*
* urns to centre.   If                              *
****************************************************
   ||    |
   ||    |        -------------------------------------------------
   ||    |       | Indicator pointer does not synchronize.        |
   ||   NOT OK----| Heading dials do not return to heading         |
   ||            | Ref. Chart 110                                 |
   ||             -------------------------------------------------
   OK
   ||
****************************************************
* Repeat action described at top of page, but with  *
* increase of heading: that is, DEC/ING No.1 (2) in *
* INC position, heading increases, heading dials    *
* turn counterclockwise, COMPASS flag appears for a *
* variation greater than 2°   IF                    *
****************************************************
   ||    |
   ||    |        -------------------------------------------------
   ||    |       | Heading dials do not turn. Flag does not appear|
   OK   NOT OK----| Ref. Chart 111                                 |
   ||             -------------------------------------------------
```

Release DEC/INV No.1 (2) switch. Place DG/MAG No.1 (2) switch in MAG position. Check that indicator heading dials concerned return to heading, that COMPASS flap disappears, on MHRS dual controller that synchronization indicator pointer returns to central. IF

- OK
- NOT OK ---- Replace Compass Coupler Unit [2], ([3])

COMPASS FLAGS REMAIN VISIBLE ON INDICATORS

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

On instrument panel place ATT INS1 (2)/ATT INS3 switch in ATT INS3 position. Flags disappear

- YES: Replace ATT INS1(2)/3 switching unit [4] ([5]). Place ATT INS 1(2) switch in ATT INS1(2) position. Flags disappear
  - NO: Replace INU [13] ([14])
- NO: On MHRS dual controller place DG/MAG NO.1(2) switch in DG position. LH (RH) red DG warning light comes on.
  - YES: Measure voltages on flux valve compensator [8] ([9])
    - YES: Replace Compass Coupler Unit [2] ([3]). Place COMP1/COMP2 switch in COMP1 position. Check aircraft magnetic heading
    - NO: Replace flux valve [10] ([11]) and compensator [9] ([10])
  - NO: Check circuit breaker [6] ([1]) ([7]) 115 VAC at output
    - NO: Replace circuit breaker [6] ([1]) ([7])

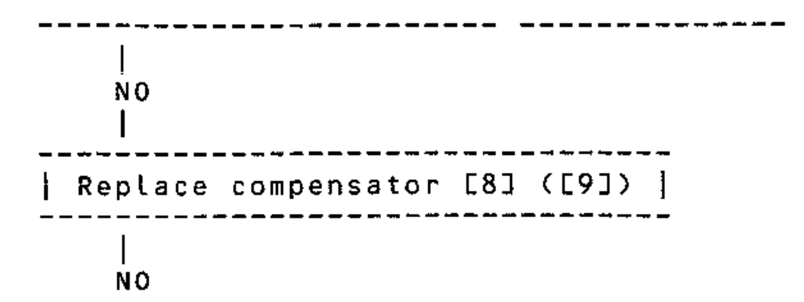


Chart 101 (Sheet 1 of 2)

| Replace flux valve [10] ([11]) |

Chart 101 (Sheet 2 of 2)

COMPASS FLAGS REMAIN VISIBLE ON THE CAPTAIN HSI AND RMI/ADF AND FIRST OFFICER RMI/VOR INDICATORS

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

Step	Result	Action
Set circuit breaker 2F130 [1]. Check disappearance of flags on Captain HSI and RMI/ADF and First Officer RMI/VOR	NO	Replace Compass Coupler Switching Unit F135 [14].
YES ↓		
Remove Compass Coupler switching unit. Measure 28VDC at terminal AA8 (AA6)	YES	Replace Compass Coupler switching unit F135 [14]
NO ↓		
Place Captain and First Officer COMP1/COMP2 switches in COMP2 (1) position. Measure 28VDC at terminal AA6 (AA8)	YES	Replace switch 1F133 [15] (2F133 [16])
NO ↓		
Replace circuit breaker 1F134 [17] 2F134 [18]		

Chart 102

COMPASS FLAGS REMAIN VISIBLE ON FIRST OFFICER HSI AND RMI/ADF AND CAPTAIN RMI/VOR

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

Step	Result	Action
Set circuit breaker 2F130 [1]. check disappearance of flags on First Officer HSI and RMI/ADF and Captain RMI/VOR	NO	Replace compass coupler switching unit F135 [14]
YES ↓		
Remove compass coupler switching unit. Measure 28VDC at terminal AB6 (AB8)	YES	Replace compass coupler switching unit F135 [14]
NO ↓		
Place Captain and First Officer COMP1/COMP2 switches in COMP2(1) position. Measure 28VDC at terminal AB8 (AB6)	NO	Replace circuit breaker [18] ([17])
YES ↓		
Check switch 2F133 (continuity between terminals 1 and 2)	NO	Replace switch 2F33 [16]
YES ↓		
Replace switch 1F33 [15]		

Chart 103

COMPASS FLAG REMAINS VISIBLE ON CAPTAIN (FIRST OFFICER) HSI

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

With circuit breaker 2F130 [1] set. Place COMP1/COMP2 switch in COMP2 (1) position. Flag remains visible

- NO → Replace compass coupler unit [2] ([3])
  - NO → Replace compass coupler switching unit F135 [14]
- YES → Place Captain (First Officer) RAD/INS switch in INS position. Flag remains visible
  - YES → Replace HSI [19] ([20])
  - NO → Replace RAD/INS switching unit [21] ([22]) and place RAD/INS switch in RAD posit-ion.

Chart 104

```
*************************************--------------------------------
* COMPASS FLAG REMAINS VISIBLE ON    *| GROUND EQUIPMENT REQUIRED   |
* CAPTAIN RMI/ADF                    *|-----------------------------|
**************************************| DESCRIPTION       PART NO.  |
                                      |-----------------------------|
                                      | MULTIMETER                  |
                                      -------------------------------

--------------------------------------     -------------------------
| Place Captain COMP1/COMP2 switch in|     | Replace Captain RMI/   |
| COMP2 position. Flag disappears    |--NO-| ADF [23]               |
--------------------------------------     -------------------------
     |
    YES
     |
--------------------------------------     -------------------------
| Place First Officer COMP1/COMP2    |     | Replace compass coupl-|
| switch in COMP1 position. Flag is  |--NO-| er switching unit F135|
| visible on the two RMI/ADF         |     | [14]                  |
--------------------------------------     -------------------------
     |
    YES
     |
-----------------------------------
| Replace compass coupler unit [2]|
-----------------------------------
```

Chart 105

COMPASS FLAG REMAINS VISIBLE ON FIRST OFFICER RMI/VOR

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

Place Captain COMP1/COMP2 switch in COMP2 position. Flag disappears
- NO → Replace Captain RMI/VOR [25]
- YES ↓

Place First Officer COMP1/COMP2 switch in COMP1 position. Flag appears on First Officer HSI
- NO → Replace compass coupler switching unit F135 [14]
- NO ↓

Replace compass coupler unit [2]

Chart 106

```
*************************************-------------------------------
* PLACE FIRST OFFICER COMP1/COMP2    *| GROUND EQUIPMENT REQUIRED    |
* SWITCH IN COMP2 POSITION. COMPASS  *|------------------------------|
* FLAGS APPEAR ON FIRST OFFICER HSI  *| DESCRIPTION        PART NO.  |
* AND RMI/ADF AND CAPTAIN RMI/VOR    *|------------------------------|
*************************************| MULTIMETER                   |
                                      -------------------------------

--------------------------------------     -------------------------
| Remove compass coupler switching   |     | Replace compass coupl-|
| unit F135. Measure 28VDC at term-  |-YES-| er switching unit F135|
| inal AB8                           |     | [14]                  |
--------------------------------------     -------------------------
     |
     NO
     |
--------------------------------------     -------------------------
| Place Captain and First Officer    |     | Replace switch 2F133  |
| COMP1/COMP2 switches in COMP1 pos- |-YES-| [28]                  |
| ition. Measure 28VDC at terminal   |     -------------------------
| AB6                                |
--------------------------------------
     |
     NO
     |
--------------------------------------
| Replace circuit breaker [18]       |
--------------------------------------
```

Chart 107

```
***************************************-------------------------------
* COMPASS COUPLER 1 AND 2 HEADINGS    *| GROUND EQUIPMENT REQUIRED   |
* ARE NOT IDENTICAL                   *|-----------------------------|
***************************************| DESCRIPTION       PART NO.  |
                                       |-----------------------------|
                                       | MULTIMETER                  |
                                       -------------------------------

--------------------------------------    -------------------------
| Place ATT INS1/ATT INS3 (ATT INS2/ |    | Replace INU [12]      |
| ATT INS3) switch in ATT INS3 posit-|--NO-| ([13])               |
| ion. Deviation persists            |    -------------------------
--------------------------------------
     |
    YES
     |
--------------------------------------    -------------------------
| Replace compass coupler unit No.1  |    | Replace flux valve    |
| [2] ([3]). Deviation persists      |-YES-| compensator [8] ([9]) |
--------------------------------------    -------------------------
                                             |
                                            YES
                                             |
                                          -------------------------
                                          | Replace flux valve    |
                                          | [10] ([11])           |
                                          -------------------------
```

Chart 108

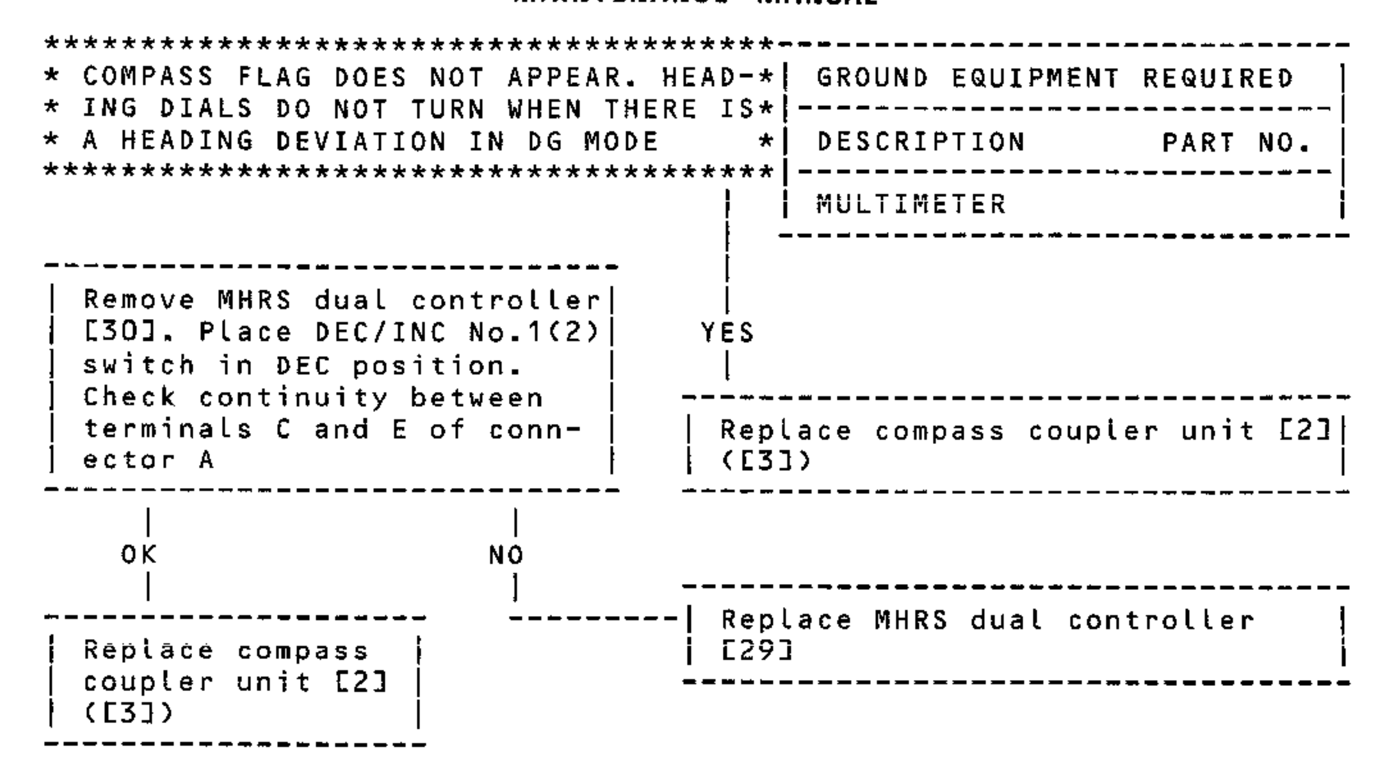

COMPASS FLAG DOES NOT APPEAR. HEADING DIALS DO NOT TURN WHEN THERE IS A HEADING DEVIATION IN DG MODE
GROUND EQUIPMENT REQUIRED
DESCRIPTION
PART NO.
MULTIMETER
Remove MHRS dual controller [30]. Place DEC/INC No.1(2) switch in DEC position. Check continuity between terminals C and E of connector A
YES
Replace compass coupler unit [2] ([3])
OK
NO
Replace compass coupler unit [2] ([3])
Replace MHRS dual controller [29]

Chart 109

INDICATOR POINTER DOES NOT SYNCHRONIZE, HEADING DIALS DO NOT RETURN TO HEADING

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

Replace MHRS dual controller [29]

NO

Replace compass coupler unit [2] ([3])

Chart 110

```
*************************************-------------------------------
* HEADING DIALS DO NOT TURN, FLAG    *| GROUND EQUIPMENT REQUIRED  |
* DOES NOT APPEAR WHEN THERE IS AN   *|----------------------------|
* "INC" HEADING DEVIATION IN DG MODE *| DESCRIPTION       PART NO. |
*************************************|----------------------------|
                                     | MULTIMETER                 |
                                     ------------------------------
-------------------------------------
| Remove MHRS dual controller [29]  |
| hold DEC/INC No.1 (2) switch in INC|
| position. Check continuity between |
| terminals C and D on connector A  |
-------------------------------------
     |                          |
     NO                         NO
     |                          |
------------------------  ------------------
| Replace compass      |  | Replace MHRS dual|
| coupler unit [2] ([3])|  | controller [29]  |
------------------------  ------------------
```

Chart 111

```
*************************************-------------------------------
* RED WARNING LIGHT DOES NOT COME ON,*| GROUND EQUIPMENT REQUIRED   |
* HEADING DIALS ARE NOT FIXED WHEN   *|-----------------------------|
* DEC/INC SWITCH IS RELEASED         *| DESCRIPTION       PART NO.  |
*************************************|-----------------------------|
                                     | MULTIMETER                   |
                                     -------------------------------

-------------------------------------     --------------------------
| Place INC/DEC No.1(2) switch in INC|    | Remove MHRS dual cont-  |
| and DEC positions alternately.     |-NO-| roller [29]. Check con- |
| Check that heading dials remain    |    | tinuity between termin- |
| fixed when switch is released.     |    | als H and J on connect- |
-------------------------------------     | or A                    |
     |                                    --------------------------
    YES                                      |               |
     |                                      YES              NO
--------------------                         |               |
| Replace DG warning|        -------------------------  ----------------
| light bulb        |        | Replace compass coupler| | Replace MHRS  |
--------------------         | unit [2] ([3])         | | dual controll-|
                             -------------------------  | er [29]       |
                                                        ----------------
```

Chart 112

	ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
R	[1] Compass coupler 2 NORM SUP		13-216	2F130	Map Ref. D15	24-50-00 R/I	34-21-05
R	[2] Compass coupler unit No.1	Door 123BB	26-123	1F126	Shelf	34-21-35 R/I	34-21-01
R	[3] Compass coupler unit No.2	Door 123BB	26-123	2F126	Shelf	34-21-35 R/I	34-21-05
R	[4] ATT INS 1/3 switching unit	Door 123BB	26-123	1F9	Shelf	34-45-35 R/I	34-21-01
R	[5] ATT INS 2/3 switching unit	Door 123BB	26-123	2F9	Shelf	34-45-35 R/I	34-21-05
	[6] Compass coupler 1 SUP		2-213	1F130	Map Ref. F8	24-50-00 R/I	34-21-01
R	[7] Compass coupler 2		13-215	2F131	Map Ref. B7	24-50-00 R/I	34-21-05
R	[8] Flux valve compensator	Door 123BB	12-123	1F129	Shelf	34-21-18 R/I	34-21-01
R	[9] Flux valve compensator	Door 123BB	12-123	2F129	Shelf	34-21-18 R/I	34-21-05
R	[10] Flux valve	Door 231AT	231	1F127	Passenger compart-ment	34-21-17 R/I	34-21-01
R	[11] Flux valve	Door 233BT	233	2F127	Passenger compart-ment	34-21-17 R/I	34-21-05
R	[12] INU No.1	Door 123BB	27-123	1F8	Shelf	34-45-34 R/I	34-21-01
R	[13] INU No.2	Door 123BB	27-123	2F8	Shelf	34-45-34 R/I	34-21-01

	ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
R	[14] Compass coupler switching unit	Door 123BB	26-123	F135	Shelf	34-21-31 R/I	34-21-06
R	[15] COMP1/COMP 2 switch		2-211	1F133	CAPT INST panel	34-21-41 R/I	34-21-02
R	[16] COMP1/ COMP2 switch		2-212	2F133	1ST OFF INST panel	34-21-41 R/I	34-21-06
R	[17] Compass coupler SYS 1 SW SUP		1-213	1F134	Map Ref. F14	24-50-00 R/I	34-21-02
R	[18] Compass coupler SYS 2 SW SUP		15-216	2F134	Map Ref. A21	24-50-00 R/I	34-21-06
R	[19] Captain HSI		2-211	1F22	Flt. Cpt	34-23-11 R/I	34-21-02
R	[20] 1ST OFF HSI		2-212	2F22	Flt. Cpt	34-23-11 R/I	34-21-06
R	[21] RAD/INS switching unit		215	1F24	7-215	34-23-13 R/I	34-21-02
R	[22] RAD/INS switching unit		216	2F24	5-216	34-23-13 R/I	34-21-06
R	[23] Captain RMI (ADF)		2-211	1R182	Flt. Cpt	34-53-21 R/I	34-21-02
R	[24] 1ST OFF RMI (ADF)		2-212	2R182	Flt. Cpt	34-53-21 R/I	34-21-06
R	[25] Captain RMI (VOR)		2-211	1R27	Flt. Cpt	34-55-22 R/I	34-21-06
R	[26] 1ST OFF RMI (VOR)		2-212	2R27	Flt. Cpt	34-55-22 R/I	34-21-02
R	[27] Captain compass switch		2-211	1F133	Flt. Cpt	34-21-41 R/I	34-21-02

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
R [28] 1ST OFF compass switch		2-212	2F133	Flt. Cpt	34-21-41 R/I	34-21-06
R [29] MHRS dual controller		8-214	F125	Flt. Cpt	34-21-12 R/I	34-21-01

Component Identification
Table 101

R **ON A/C 006-007,

COMPASS COUPLER - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
INS COMPTR SUP2	2-213	F 3	A 6
HSI TRUE 1ST PLT INS1 SUP & IND		1F 21	B 6
ADI 1ST PLT INS1 SUP & IND		1F 15	A 7
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RMI VHF NAV1 IND		1R 34	C 6
ADF1 IND		1R 174	C 7
INS1 HTR SUP		1F 14	E 6
INS1 SUP		1F 20	F 6
COMPASS COUPLER 1 SUP		1F 130	F 8
FLT CONT & NAV BUS 14XS		X 355	H 2
INS COMPTR SUP3	13-216	F 2	B15
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
NAV INST BUS 13XS		X 345	G 4

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYS2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) On Captain instrument panel (2-211) place switches :

- ATT INS1/INS3 in ATT INS1 position.
- COMP1/COMP2 in COMP1 position.
- NAV INS1/NAV INS2 in NAV INS1 position.

(5) On First Officer instrument panel (2-212) place switches :

- ATT INS3/INS2 in ATT INS2 position.
- COMP1/COMP2 in COMP2 position.
- NAV INS1/INS2 in NAV INS2 position.

(6) On glareshield instrument panel, on 5-211, place Captain and First Officer RAD/INS switches in RAD position and check :
- On Captain and First Officer instrument panels on HSI indicators, that desired track dagger pointer indicates same value as that selected in RH window at sides 1 and 2 of AFCS control unit.

(7) Put into operation the INS systems (Ref. 34-45-00, Adjustment/Test).

(8) On Flight Engineer panel 7=214 place DG/MAG switch on compass coupler control panel in MAG position, galvanometers must be centred.

(9) On Captain and First Officer instrument panels check that :

(a) On HSI indicators :

- RAD and MAG markers are visible.
- HDG compass flag disappears at status 90 on INS.

(b) On RMI/ADF and RMI/VOR indicators, compass flags are retracted.

C. Tests

(1) Check of MAG mode :

(a) Compass coupler 1 :
- Check on Captain HSI and RMI/ADF and First Officer RMI/VOR indicators that magnetic heading is identical within 1°.

(b) Compass coupler 2 :
- Check on First Officer HSI and RMI/ADF and Captain RMI/VOR indicators that magnetic heading is identical within 1°.

NOTE : Note magnetic heading values on the various indicators for later checks.

(2) Check of compass coupler 1 directional mode

NOTE : Deviations to select in INC/DEC operation, where not mentioned, are approximately 6 degrees.

(a) Place DG/MAG No.1 switch on compass coupler control panel, LH side, in DG position, LH red indicator light illuminates.

(b) Place and hold DEC/INC No.1 switch in INC position.
- Heading reading on Captain HSI and RMI/ADF and First Officer RMI/VOR increases (counterclockwise rotation of heading dials).
- COMPASS flag appears when variation is 2° or greater.
- Release switch, heading dials remain fixed.

(c) Place and hold DEC/INC No.1 switch in DEC position.
- Heading reading on Captain HSI and RMI/ADF and First Officer RMI/VOR decreases (clockwise rotation of heading dials).
- COMPASS flag appears when variation is 2° or greater.
- Release switch, heading dials remain fixed.

(d) By means of DEC/INC No.1 switch, select heading which differs by approximately 170° from initial magnetic heading, place DG/MAG No.1 switch in MAG position :

- LH red indicator light extinguishes.
- Captain HSI and RMI/ADF and First Officer RMI/VOR indicator heading dials return to initial heading in less than 60 seconds.

(3) Check of compass coupler 2 directional mode

NOTE : Deviations to be selected in INC/DEC operation, where not mentioned, are approximately 6 degrees.

(a) Place and hold DG/MAG No.2 switch on compass coupler control panel, RH side, in DG position.
- RH red indicator light illuminates.

(b) Place and hold DEC/INC No.2 switch in INC position.
- Heading reading on First Officer HSI and RMI/ADF and Captain RMI/VOR increases (counterclockwise rotation of heading dials).
- COMPASS flag appears when variation is 2° or greater.
- Release switch, heading dials remain fixed.

(c) Place and hold DEC/INC No.2 switch in DEC position.
- Heading reading on First Officer HSI and RMI/ADF and Captain RMI/VOR decreases (clockwise rotation of heading dials).
- COMPASS flag appears when variation is 2° or greater.
- Release switch, heading dials remain fixed.

(d) By means of DEC/INC No.2 switch, select heading which differs by approximately 170° from initial magnetic heading then place DG/MAG No.2 switch in MAG position.

- RH red indicator light extinguishes.
- First Officer HSI and RMI/ADF and Captain. RMI/VOR heading dials return to initial heading in less than 60 seconds.

(4) Check of both compass couplers in directional mode with INS3.

(a) On Captain instrument panel (2-211), place ATT INS1/INS3 switch in ATT INS3 position :

- Compass coupler flag is visible for approximately 5 seconds on Captain HSI and RMI/ADF and on First Officer RMI/VOR, then disappears.

(b) On First Officer instrument panel (2-212), place ATT INS2/ATT INS3 switch in ATT INS3 position :

- Compass coupler flag is visible for approximately 5 seconds on First Officer HSI and RMI/ADF and on Captain RMI/VOR, then disappears.

(c) On compass coupler control panel place DG/MAG No.1 switch in DG position, then by means of DEC/INC No.1 switch rotate Captain HSI and RMI/ADF and First Officer RMI/VOR indicator heading dials by approximately 6 degrees.

(d) Place DG/MAG No.1 switch in MAG position

- LH indicator light extinguishes.
- Indicator heading dials return to initial heading.

(e) On compass coupler control panel place DG/MAG No.2 switch in DG position, then by means of DEC/INC No.2 switch rotate First Officer HSI, RMI/ADF and Captain RMI/VOR indicator heading dials by approximately 6 degrees.

(f) Place DG/MAG No.2 switch in MAG position

- RH red indicator light extinguishes.
- Indicator heading dials return to initial heading.

(5) Check of both COMP1/COMP2 switches.

(a) On First Officer instrument panel (2-212), place COMP1/COMP2 switch in COMP1 position.

(b) On compass coupler control panel, place DG/MAG No.1 switch in DG position, then place and hold DEC/INC No.1 switch to RH side or LH side :
- HDG and COMPASS flags appear on Captain and First Officer HSI, and RMI (ADF, VOR).

(c) Release DEC/INC switch
- HDG and COMPASS flags disappear and heading

readings are identical within 1° on Captain and First Officer HSI and RMI (ADF, VOR).

(d) On First Officer instrument panel (2-212), place COMP1/COMP2 switch in COMP2 position.

(e) On Captain instrument panel (2-211), place COMP1/COMP2 switch in COMP2 position.

(f) On compass coupler control panel, place DG/MAG No.2 switch in DG position, then place and hold DEC/INC No.2 switch to RH side or LH side :
- HDG and COMPASS flags appear on Captain and First Officer HSI and RMI (ADF/VOR).

(g) Release DEC/INC switch
- HDG and COMPASS flags disappear and heading readings are identical within 1° on Captain and First Officer HSI and RMI (ADF, VOR).

(h) On Captain instrument panel (2-211), place COMP1/COMP2 switch in COMP1 position.

D. Close-Up

(1) Switch off INS systems (Ref. 34-45-00, Adjustment/Test).

(2) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Page 301, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Access Platform, Height of Access 3.46 m (11 ft. 4 in.)	
Connector, DEUTSCH 95106RC2255 (For INS)	
Terminals A and U to be Linked	

B. Prepare

(1) Position access platform at INS compartment.

(2) Open INS compartment access door. Door No.123BB.

(3) Remove INS compartment forward panel.

(4) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
INS COMPTR SUP2	2-213	F 3	A 6
HSI TRUE 1ST PLT INS1 SUP & IND		1F 21	B 6
ADI 1ST PLT INS1 SUP & IND		1F 15	A 7
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RMI VHF NAV1 IND		1R 34	C 6
ADF1 IND		1R 174	C 7
INS1 HTR SUP		1F 14	E 6
INS1 SUP		1F 20	F 6
COMPASS COUPLER 1 SUP		1F 130	F 8

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS		X 355	H 2
INS COMPTR SUP3	13-216	F 2	B15
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
NAV INST BUS 13XS		X 345	G 4
COMPASS COUPLER SYS2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21

(5) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Page 301, Servicing).

(6) Switch on electronics rack ventilation system (Ref. 21-21-00).

(7) On Captain instrument panel (2-211), place switches :

- ATT INS1/ATT INS3 in ATT INS1 position.
- COMP1/COMP2 in COMP1 position.
- NAV INS1/NAV INS2 in NAV INS2 position.

(8) On First Officer instrument panel (2-212) place switches :

- ATT INS3/ATT INS 2 in ATT INS2 position.
- COMP1/COMP2 in COMP2 position.
- NAV INS1/NAV INS2 in NAV INS2 position.

(9) On Glareshield instrument panel (5-211), place Captain and First Officer RAD/INS switches in RAD position and check :
- On Captain and First Officer instrument panels on HSI indicators, that desired track dagger pointer indicates same value as that selected in RH window at sides 1 and 2 of AFCS control unit.

(10) Put into operation the INS systems (Ref. 34-45-00, Adjustment/Test).

(11) On Flight Engineer panel 7-214, place DG/MAG switches on compass coupler control unit in MAG position, galvanometers must be centred.

(12) On Captain and First Officer instrument panels check :

(a) On the HSI indicators that :

- RAD and MAG markers are visible.
- HDG compass flag disappears at status 90 on INS

(b) On RMI/ADF and RMI/VOR indicators that compass flags are retracted.

C. Tests

(1) Check of MAG mode

(a) Compass coupler 1 :
- Check on Captain HSI and RMI/ADF and First Officer RMI/VOR that magnetic heading is identical within 1°.

(b) Compass coupler 2 :
- Check on First Officer HSI and RMI/ADF and Captain RMI/VOR that magnetic heading is identical within 1°.

NOTE : Note magnetic heading value on the various indicators for later checks.

(2) Check of servo control monitoring activation

(a) On compass coupler control panel place and hold DEC/INC No.1 and 2 switches in DEC or INC position in order to display a heading which differs by 30° to 35° from initial magnetic heading.

(b) Release DEC/INC switches and check :

(b1) That heading indicators return to initial heading at a rate of 3° ± 1° per minute.

(b2) On Captain and First Officer HSI, RMI/VOR & RMI/ADF that compass flags :

- are visible after 5 minutes ± 1 minute.
- disappear when heading difference is less than 10° ± 1°.

(b3) That initial magnetic heading is again indi-

cated on above indicators after approximately 10 to 12 minutes.

(3) Check of compass coupler 1 directional mode

(a) Place DG/MAG No.1 switch on compass coupler control panel, LH side, in DG position, LH red indicator light illuminates.

(b) Place and hold DEC/INC No.1 switch in INC position for 15 seconds and check on Captain HSI and RMI/ADF and First Officer RMI/VOR that initial heading is increased by 100° ± 25°.
Release switch, heading dials remain at this value

(c) Place and hold DEC/INC No.1 switch in DEC position for 15 seconds and check on Captain HSI and RMI/ADF and First Officer RMI/VOR that heading is decreased by 100° ± 25°. Release switch, heading dials remain at this value.

(d) By means of DEC/INC No.1 switch, select heading which differs by approximately 170° from initial magnetic heading, place DG/MAG No.1 switch in MAG position.

- LH red indicator light extinguishes.
- Captain HSI and RMI/ADF and First Officer RMI/VOR indicator heading dials return to initial heading in less than 60 seconds.

(e) On First Officer instrument panel (2-212), place COMP 1/COMP 2 switch in COMP 1 position :

(e1) Captain and First Officer HSI, RMI/ADF and RMI/VOR indicate compass coupler 1 heading within 1°.

(e2) On compass coupler control panel, place DEC/INC No.1 switch in one position, then in the other and check :
- that Captain and First Officer HSI, RMI/ADF and RMI/VOR indicators and heading dials follow heading variations.

(f) Place DG/MAG No.1 switch in MAG position :

(f1) LH red indicator light extinguishes.

(f2) Captain and First Officer HSI RMI/ADF and RMI/VOR indicator heading dials return to

initial heading.

(g) On First Officer instrument panel (2-212) place COMP 1/COMP 2 switch in COMP 2 position.

(4) Check of compass coupler 2 directional mode

(a) Place and hold DG/MAG No.2 switch on compass coupler control panel, RH side, in DG position.

- RH red indicator light illuminates.

(b) Place and hold DEC/INC No.2 switch in INC position for 15 seconds and check on First Officer HSI and RMI/ADF and Captain RMI/VOR that initial heading is increased by 100° ± 25°.
Release switch, heading dials remain at this value

(c) Place and hold DEC/INC No.2 switch in DEC position for 15 seconds and check on First Officer HSI and RMI/ADF and Captain RMI/VOR that heading is decreased by 100° ± 25°.
Release switch, heading dials remain at this value

(d) By means of DEC/INC No.2 switch, select heading which differs by approximately 170° from initial magnetic heading then place DG/MAG No.2 switch in MAG position.

- RH red indicator light extinguishes.
- Captain HSI and RMI/ADF and First Officer RMI/VOR heading dials return to initial heading in less than 60 seconds.

(e) On Captain instrument panel (2-211), place COMP 1/ COMP 2 switch in COMP 2 position.

(e1) Captain and First Officer HSI, RMI/ADF and RMI/VOR indicators indicate compass coupler 2 heading within 1°.

(e2) On compass coupler control panel, place DEC/INC No.2 switch in one position then in the other position and check :

- that Captain and First Officer HSI, RMI/ADF and RMI/VOR indicator heading dials follow heading variations.

(f) Place DG/MAG No.2 switch in MAG position.

(f1) RH red indicator light extinguishes.

(f2) Captain and First Officer HSI, RMI/ADF and RMI/VOR indicators return to initial heading.

(g) On Captain instrument panel (2-211) place COMP 1/ COMP 2 switch in COMP 1 position.

(5) Check of both compass couplers in directional mode with INS3.

(a) On Captain instrument panel (2-211) place ATT INS1/ATT INS3 switch in ATT INS3 position :

- Compass coupler flag appears for approximately 5 seconds on Captain HSI and RMI/ADF and First Officer RMI/VOR, then disappears.

(b) On First Officer instrument panel (2-212) place ATT INS2/ ATT INS3 switch in ATT INS3 position :

- Compass coupler flag appears for approximately 5 seconds on First Officer HSI and RMI/ADF and Captain RMI/VOR, then disappears.

(c) On compass coupler control panel place DG/MAG No.1 switch in DG position, then by means of DEC/INC switch rotate Captain HSI and RMI/ADF and First Officer RMI/VOR indicator heading dials by approximately six degrees.

(d) Place DG/MAG No.1 switch in MAG position

- LH indicator light extinguishes.
- indicator heading dials return to initial heading.

(e) On compass coupler control panel place DG/MAG No.2 switch in DG position, then by means of DEC/INC switch rotate First Officer HSI, RMI/ADF and Captain RMI/VOR indicator heading dials by approximately six degrees.

(f) Place DG/MAG No.2 switch in MAG position.
- RH indicator light extinguishes.
- Indicator heading dials return to initial heading.

(6) Check of compass coupler monitoring

(a) In zone 8-214, switch off INS3 by placing MSU

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No.3 selector switch in OFF position.
- On Captain and First Officer HSI, RMI/ADF and RMI/VOR compass flags appear.

(7) Check of compass coupler 1 and 2 magnetic monitoring cut-off

(a) With INS3 in OFF position, connect and lock modified DEUTSCH connector to connector J4 on INU3 front panel.

(b) Make certain that DG/MAG switches on compass coupler control panel are in MAG position.

(c) Switch on INS3. Place MSU3 selector switch in STBY position.

CAUTION : A PERIOD OF 4 MINUTES MUST ELAPSE BETWEEN A SWITCH OFF AND SWITCH ON OF AN INS SYSTEM.

(d) Insertion of an angle of 7° of roll (This value is added to initial value of roll of INS system).

- On CDU No.3 place mode selector switch in DSR TK/STS position.
- WARN indicator light flashes, Action Code No.7 and Malfunction Code No.2 appear on annunciators.
- When status 90 is reached, WARN indicator extinguishes.
- Place CDU mode selector in POS position, place AUTO/MAN/RMT in MAN position.
- Press E on CDU keyboard, select an angle of roll of 7° negative (operation is identical with insertion of latitude).
  Roll angle is stored after pressing INSERT button.
  Place MSU mode selector switch in ALIGN.
- Warn indicator light on CDU flashes, desired roll angle will be reached at a rate of 1.3° per minute.

(e) When selected roll angle value reaches 5 ± 1°, red DG indicator lights on compass coupler control panel illuminate.

(f) On compass coupler control panel by means of INC/DEC switches Nos.1 and 2 select + 6° with respect to selected magnetic heading. Check this 6° shift on Captain and First Officer HSI, RMI/ADF

and RMI/VOR and check that selected heading remains fixed.

(g) Place MSU No.3 selector switch in STBY position (INS3 returns to initial roll angle). On passing through a decreasing roll angle of 4°, red DG indicator lights on compass coupler control panel extinguish.
- From this moment check on Captain and First Officer indicators that headings return to initial magnetic heading at a rate of 3 ± 0.9 degrees per minute.

D. Close-Up

(1) Switch off inertial navigation systems (Ref. 34-45-00, Adjustment/Test).

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Page 301, Servicing).

(4) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(5) In INS compartment disconnect DEUTSCH connector from INU3 front panel connector, install INS compartment forward panel. Close INS compartment access door (123BB).

3. System Test

This test is identical with functional test described in paragraph 2.

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
INS COMPTR SUP2	2-213	F 3	A 6
HSI TRUE 1ST PLT INS1 SUP & IND		1F 21	B 6
ADI 1ST PLT INS1 SUP & IND		1F 15	A 7
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RMI VHF NAV1 IND		1R 34	C 6
ADF1 IND		1R 174	C 7
INS1 HTR SUP		1F 14	E 6
INS1 SUP		1F 20	F 6
COMPASS COUPLER 1 SUP		1F 130	F 8
FLT CONT & NAV BUS 14XS		X 355	H 2
INS COMPTR SUP3	13-216	F 2	B15
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
NAV INST BUS 13XS		X 345	G 4
COMPASS COUPLER SYS2 SW SUP	15-216	2F 134	A21

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) On Captain instrument panel (2-211) place switches

- ATT INS1/INS3 in ATT INS1 position.
- COMP1/COMP2 in COMP1 position.
- NAV INS1/NAV INS2 in NAV INS1 position.

(5) On First Officer instrument panel (2-212) place switches

- ATT INS3/INS2 in ATT INS2 position.
- COMP1/COMP2 in COMP2 position.
- NAV INS1/INS2 in NAV INS2 position.

(6) On glareshield instrument panel, on 5-211, place Captain and First Officer RAD/INS switches in RAD position and check :
- On Captain and First Officer instrument panels, on HSI, that desired track dagger pointer indicates same value as that selected in RH window at sides 1 and 2 of AFCS control unit.

(7) Start up the INS (Ref. 34-45-00, Adjustment/Test).

(8) On Flight Engineer panel 7-214 place DG/MAG switch on compass coupler control panel in MAG position : annunciators must be centred.

(9) On Captain and First Officer instrument panels check that

(a) On HSI

- RAD and MAG markers are visible.
- HDG compass flag disappears at INS status 8.

(b) On ADF/RMI and VOR/RMI, compass flags are retracted.

C. Tests

(1) Check of MAG mode

(a) Compass coupler 1
- check on Captain HSI and ADF/RMI and on First Officer VOR/RMI that magnetic heading is identical within 1°.

(b) Compass coupler 2
- check on First Officer HSI and ADF/RMI and on Captain VOR/RMI that magnetic heading is identical within 1°.

NOTE : Note magnetic heading values on the various indicators for later checks.

(2) Check of compass coupler 1 directional mode

NOTE : Deviations to select in INC/DEC operation, where not mentioned, are approximately 6 degrees.

(a) Place DG/MAG No.1 switch on compass coupler control panel, LH side, in DG position : LH red indicator light illuminates.

(b) Place and hold DEC/INC No.1 switch in INC position
- heading reading on Captain HSI and ADF/RMI and on First Officer VOR/RMI increases (anticlockwise rotation of heading dials).
- COMPASS flag appears when variation is 2° or greater.
- release switch : heading dials remain fixed.

(c) Place and hold DEC/INC No.1 switch in DEC position
- heading reading on Captain HSI and ADF/RMI and on First Officer VOR/RMI decreases (clockwise rotation of heading dials).
- COMPASS flag appears when variation is 2° or greater.
- release switch : heading dials remain fixed.

(d) By means of DEC/INC No.1 switch, select heading which differs by approximately 170° from initial magnetic heading, place DG/MAG No.1 switch in MAG

position

- LH red indicator light extinguishes.
- Captain HSI and ADF/RMI and First Officer VOR/RMI heading dials return to initial heading in less than 60 seconds.

(3) Check of compass coupler 2 directional mode

NOTE : Deviations to be selected in INC/DEC operation, where not mentioned, are approximately 6 degrees.

(a) Place and hold DG/MAG No.2 switch on compass coupler control panel, RH side, in DG position.
- RH red indicator light illuminates.

(b) Place and hold DEC/INC No.2 switch in INC position.
- heading reading on First Officer HSI and ADF/RMI and on Captain VOR/RMI increases (anti-clockwise rotation of heading dials).
- COMPASS flag appears when variation is 2° or greater.
- release switch : heading dials remain fixed.

(c) Place and hold DEC/INC No.2 switch in DEC position
- heading reading on First Officer HSI and ADF/RMI and on Captain VOR/RMI decreases (clockwise rotation of heading dials).
- COMPASS flag appears when variation is 2° or greater.
- release switch : heading dials remain fixed.

(d) By means of DEC/INC No.2 switch, select heading which differs by approximately 170° from initial magnetic heading then place DG/MAG No.2 switch in MAG position.

- RH red indicator light extinguishes.
- First Officer HSI and ADF/RMI and Captain VOR/RMI heading dials return to initial heading in less than 60 seconds.

(4) Check of both compass couplers in directional mode with INS3.

(a) On Captain instrument panel (2-211), place ATT INS1/INS3 switch in ATT INS3 position

- compass coupler flag is visible for approximately 5 seconds on Captain HSI and ADF/RMI and on First Officer VOR/RMI, then disappears.

(b) On First Officer instrument panel (2-212), place ATT INS2/ATT INS3 switch in ATT INS3 position

- compass coupler flag is visible for approximately 5 seconds on First Officer HSI and ADF/RMI and on Captain VOR/RMI, then disappears.

(c) On compass coupler control panel place DG/MAG No.1 switch in DG position, then by means of DEC/INC No.1 switch rotate Captain HSI and ADF/RMI and First Officer VOR/RMI heading dials by approximately 6 degrees.

(d) Place DG/MAG No.1 switch in MAG position

- LH indicator light extinguishes.
- Indicator heading dials return to initial heading.

(e) On compass coupler control panel place DG/MAG No.2 switch in DG position, then by means of DEC/INC No.2 switch rotate First Officer HSI, ADF/RMI and Captain VOR/RMI heading dials by approximately 6 degrees.

(f) Place DG/MAG No.2 switch in MAG position

- RH red indicator light extinguishes.
- indicator heading dials return to initial heading.

(5) Check of both COMP1/COMP2 switches.

(a) On First Officer instrument panel (2-212), place COMP1/COMP2 switch in COMP1 position.

(b) On compass coupler control panel, place DG/MAG No.1 switch in DG position, then place and hold DEC/INC No.1 switch to RH side or LH side
- HDG and COMPASS flags appear on Captain and First Officer HSI and RMI (ADF, VOR).

(c) Release DEC/INC switch
- HDG and COMPASS flags disappear and heading readings are identical within 1° on Captain and First Officer HSI and RMI (ADF, VOR).

(d) On First Officer instrument panel (2-212) place COMP1/COMP2 switch in COMP2 position.

(e) On Captain instrument panel (2-211), place COMP1/COMP2 switch in COMP2 position.

(f) On compass coupler control panel, place DG/MAG No.2 switch in DG position, then place and hold DEC/INc No.2 switch to RH side or LH side
- HDG and COMPASS flags appear on Captain and First Officer HSI and RMI (ADF, VOR).

(g) Release DEC/INC switch
- HDG and COMPASS flags disappear and heading readings are identical within 1° on Captain and First Officer HSI and RMI (ADF, VOR).

(h) On Captain instrument panel (2-211) place COMP1/COMP2 switch in COMP1 position.

D. Close-Up

(1) Switch off INS systems (Ref. 34-45-00, Adjustment/Test)

(2) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Page 301, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
INS COMPTR SUP2	2-213	F 3	A 6
HSI TRUE 1ST PLT INS1 SUP & IND		1F 21	B 6
ADI 1ST PLT INS1 SUP & IND		1F 15	A 7
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RMI VHF NAV1 IND		1R 34	C 6
ADF1 IND		1R 174	C 7
INS1 HTR SUP		1F 14	E 6
INS1 SUP		1F 20	F 6
COMPASS COUPLER 1 SUP		1F 130	F 8
FLT CONT & NAV BUS 14XS		X 355	H 2
INS COMPTR SUP3	13-216	F 2	B15
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
NAV INST BUS 13XS		X 345	G 4
COMPASS COUPLER SYS2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Page 301, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) On Captain instrument panel (2-211), place switches

- ATT INS1/ATT INS3 in ATT INS1 position.
- COMP1/COMP2 in COMP1 position.
- NAV INS1/NAV INS2 in NAV INS2 position.

(5) On First Officer instrument panel (2-212) place switches

- ATT INS3/ATT INS 2 in ATT INS2 position.
- COMP1/COMP2 in COMP2 position.
- NAV INS1/NAV INS2 in NAV INS2 position.

(6) On Glareshield instrument panel (5-211), place Captain and First Officer RAD/INS switches in RAD position and check
- on Captain and First Officer instrument panels, on HSI, that desired track dagger pointer indicates same value as that selected in RH window at sides 1 and 2 of AFCS control unit.

(7) Start up the INS (Ref. 34-45-00)

(8) On Flight Engineer panel 7-214, place DG/MAG switches on compass coupler control unit in MAG position, annunciators must be centred.

(9) On Captain and First Officer instrument panels check

(a) On HSI that

- RAD and MAG markers are visible.
- HDG compass flag disappears at INS status 8

(b) On ADF/RMI and VOR/RMI that compass flags are retracted.

C. Tests

(1) Check of MAG mode

(a) Compass coupler 1
- check on Captain HSI and ADF/RMI and on First Officer VOR/RMI that magnetic heading is iden-

tical within 1°.

(b) Compass coupler 2
- check on First Officer HSI and ADF/RMI and on Captain VOR/RMI that magnetic heading is identical within 1°.

NOTE : Note magnetic heading value on the various indicators for later checks.

(2) Check of servo control monitoring activation

(a) On compass coupler control panel place and hold DEC/INC No.1 and 2 switches in DEC or INC position in order to display a heading which differs by 30° to 35° from initial magnetic heading.

(b) Release DEC/INC switches and check

(b1) That heading indicators return to initial heading at a rate of 3° ± 1° per minute.

(b2) On Captain and First Officer HSI, VOR/RMI & ADF/RMI that compass flags

- are visible after 5 minutes ± 1 minute.
- disappear when heading difference is less than 10° ± 1°.

(b3) That initial magnetic heading is again indicated on above indicators after approximately 10 to 12 minutes.

(3) Check of compass coupler 1 directional mode

(a) Place DG/MAG No.1 switch on compass coupler control panel, LH side, in DG position : LH red indicator light illuminates.

(b) Place and hold DEC/INC No.1 switch in INC position for 15 seconds and check on Captain HSI and ADF/RMI and on First Officer VOR/RMI that initial heading is increased by 100° ± 25°.
Release switch : heading dials remain at this value.

(c) Place and hold DEC/INC No.1 switch in DEC position for 15 seconds and check on Captain HSI and ADF/RMI and on First Officer VOR/RMI that heading is decreased by 100° ± 25°. Release switch : heading dials remain at this value.

(d) By means of DEC/INC No.1 switch, select heading which differs by approximately 170° from initial magnetic heading ; place DG/MAG No.1 switch in MAG position.

- LH red indicator light extinguishes.
- Captain HSI and ADF/RMI and First Officer VOR/RMI heading dials return to initial heading in less than 60 seconds.

(e) On First Officer instrument panel (2-212), place COMP 1/COMP 2 switch in COMP 1 position

(e1) Captain and First Officer HSI, ADF/RMI and VOR/RMI indicate compass coupler 1 heading within 1°.

(e2) On compass coupler control panel, place DEC/INC No.1 switch in one position, then in the other and check
- that Captain and First Officer HSI, ADF/RMI and VOR/RMI heading dials follow heading variations.

(f) Place DG/MAG No.1 switch in MAG position

(f1) LH red indicator light extinguishes.

(f2) Captain and First Officer HSI, ADF/RMI and VOR/RMI heading dials return to initial heading.

(g) On First Officer instrument panel (2-212) place COMP 1/COMP 2 switch in COMP 2 position.

(4) Check of compass coupler 2 directional mode

(a) Place and hold DG/MAG No.2 switch on compass coupler control panel, RH side, in DG position

- RH red indicator light illuminates.

(b) Place and hold DEC/INC No.2 switch in INC position for 15 seconds and check on First Officer HSI and ADF/RMI and on Captain VOR/RMI that initial heading is increased by 100° ± 25°.
Release switch : heading dials remain at this value.

(c) Place and hold DEC/INC No.2 switch in DEC position for 15 seconds and check on First Officer HSI and

ADF/RMI and on Captain VOR/RMI that heading is decreased by 100° ± 25°.
Release switch : heading dials remain at this value.

(d) By means of DEC/INC No.2 switch, select heading which differs by approximately 170° from initial magnetic heading then place DG/MAG No.2 switch in MAG position.

- RH red indicator light extinguishes.
- Captain HSI and ADF/RMI and First Officer VOR/RMI heading dials return to initial heading in less than 60 seconds.

(e) On Captain instrument panel (2-211), place COMP 1/ COMP 2 switch in COMP 2 position.

(e1) Captain and First Officer HSI, ADF/RMI and VOR/RMI indicate compass coupler 2 heading within 1°.

(e2) On compass coupler control panel, place DEC/INC No.2 switch in one position then in the other position and check

- that Captain and First Officer HSI, ADF/RMI and VOR/RMI heading dials follow heading variations.

(f) Place DG/MAG No.2 switch in MAG position.

(f1) RH red indicator light extinguishes.

(f2) Captain and First Officer HSI, ADF/RMI and VOR/RMI return to initial heading.

(g) On Captain instrument panel (2-211) place COMP 1/ COMP 2 switch in COMP 1 position.

(5) Check of both compass couplers in directional mode with INS3.

(a) On Captain instrument panel (2-211) place ATT INS1/ATT INS3 switch in ATT INS3 position

- compass coupler flag appears for approximately 5 seconds on Captain HSI and ADF/RMI and on First Officer VOR/RMI, then disappears.

(b) On First Officer instrument panel (2-212) place

ATT INS2/ ATT INS3 switch in ATT INS3 position

- compass coupler flag appears for approximately 5 seconds on First Officer HSI and ADF/RMI and on Captain VOR/RMI, then disappears.

(c) On compass coupler control panel place DG/MAG No.1 switch in DG position, then by means of DEC/INC switch rotate Captain HSI and ADF/RMI and First Officer VOR/RMI heading dials by approximately six degrees.

(d) Place DG/MAG No.1 switch in MAG position

- LH indicator light extinguishes.
- indicator heading dials return to initial heading.

(e) On compass coupler control panel place DG/MAG No.2 switch in DG position, then by means of DEC/INC switch rotate First Officer HSI, ADF/RMI and Captain VOR/RMI heading dials by approximately six degrees.

(f) Place DG/MAG No.2 switch in MAG position
- RH indicator light extinguishes.
- indicator heading dials return to initial heading.

(6) Check of compass coupler monitoring

(a) In zone 8-214, switch off INS3 by placing MSU No.3 selector switch in OFF position
- on Captain and First Officer HSI, ADF/RMI and VOR/RMI, compass flags appear.

D. Close-Up

(1) Switch off inertial navigation systems (Ref. 34-45-00, Adjustment/Test).

(2) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Page 301, Servicing).

3. System Test

This test is identical with functional test described in paragraph 2.

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MHRS CONTROLLER - REMOVAL/INSTALLATION

1. General

Dual MHRS controller F125 is located on the Flight Engineer's panel 8-214, on RH lower panel.

2. MHRS Controller

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER 1 SUP	2-213	1F 130	F 8
COMPASS COUPLER 2 STBY SUP	13-215	2F 131	B 7
COMPASS COUPLER 2 NORM SUP	13-216	2F 130	D15
3CM STN RH INST LTS SUP		L 377	E 7

C. Remove

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.F.

F. Close-Up

(1) Remove safety clips and tags and reset the circuit

breakers tripped in paragraph 2.B.(1)

(2) Carry out an operational test of the relevant system (Ref. 34-21-00, Adjustment/Test).

FLUX VALVE - REMOVAL INSTALLATION

1. General

R Removal for replacement or check.
R The two flux valves are identical, but their mounting on the
R aircraft is different, depending on their location.
R Compass coupler 1 flux valve 1 (1F 127) is in zone 231 and
R compass coupler 2 flux valve 2 (2F 127) is in zone 233.

CAUTION : FLUX VALVE BEING HIGHLY SENSITIVE TO MAGNETIC INTERFERENCE, INSTALLATION AND REPLACEMENT MUST BE DONE
R WITH NON-MAGNETIC PARTS OR TOOLS.

2. Flux valve

A. Equipment and materials.

DESCRIPTION	PART NO.
R Access Platform, 6.670 m (21 ft. 11 in.)	
Circuit Breaker Safety Clips	
Non-Magnetic Wrench	

B. Prepare

R (1) Trip, safety and tag those of the following circuit
R breakers corresponding to system on which removal/
R installation is to be carried out :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYS 1 SW SUP	1-213	1F 134	F14
COMPASS COUPLER 1 SUP	2-213	1F 130	F 8
COMPASS COUPLER 2 STBY SUP	13-215	2F 131	B 7
COMPASS COUPLER 2 NORM SUP	13-216	2F 130	D15

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYS 2 SW SUP	15-216	2F 134	A21

(2) Position access platform

C. Remove

**ON A/C 002-002,

(1) Flux valve 1 (Ref. Fig. 401)

(a) Remove the five screws attaching door 231AT (1) (three lateral screws and two upper screws), and open door.

NOTE : Use non-magnetic wrench.

(b) Remove non-magnetic screw (4) with non-magnetic washer holding clamp (5) and flux valve lead (7) and free from bracket (6) (Note position of clamp for installation).

(c) Disconnect connector (8) on flux valve lead.

(d) Remove the four non-magnetic screws (3) with non-magnetic washers attaching flux valve to bracket.

(e) Remove flux valve (2), lifting vertically.

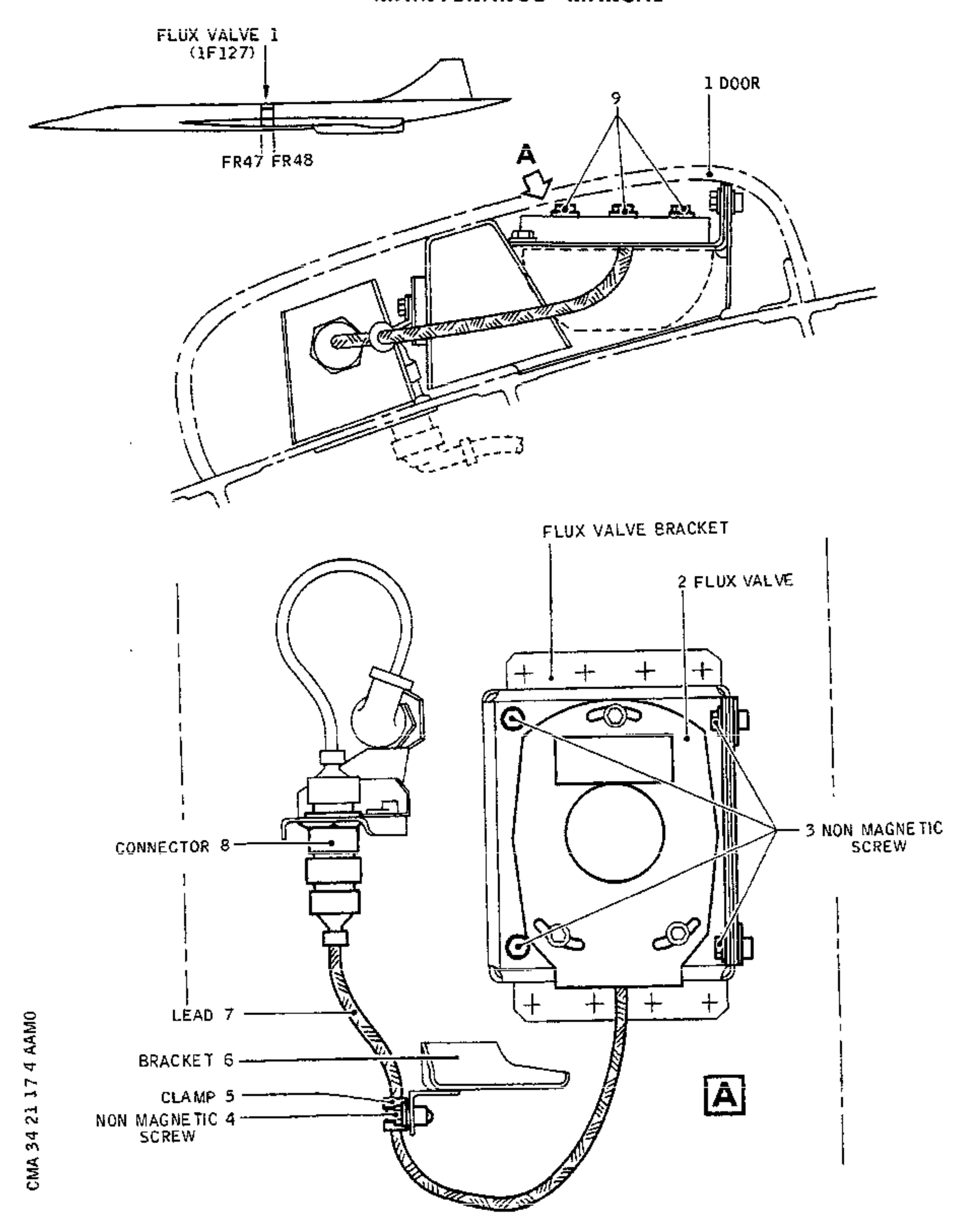
R After SB 34-021 For A/C 002-002,

(1) Flux valve 1 (Ref. Fig. 402)

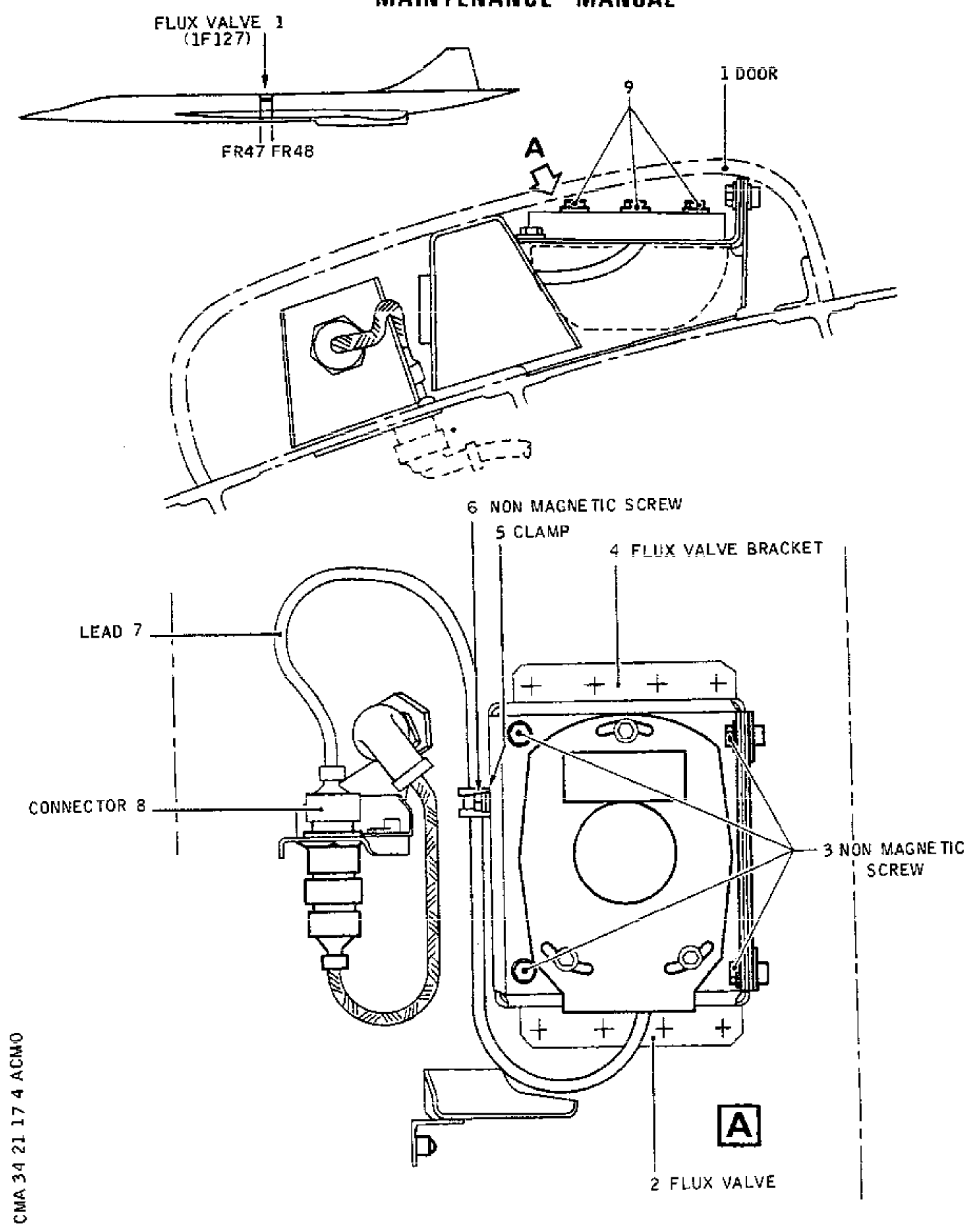
(a) Remove the five screws attaching door 231AT (1) (three lateral screws and two upper screws), and open door.

NOTE : Use non-magnetic wrench.

(b) Remove non-magnetic screw (6) with non-magnetic washer holding clamp (5) and flux valve lead (7) and free from flux valve bracket (4).



Flux Valve 1 - Removal/Installation
Figure 401



CMA 34 21 17 4 ACMO

R

Flux Valve 1 - Removal/Installation
Figure 402

(c) Disconnect connector (8) on flux valve (2) lead.

(d) Remove the four non-magnetic screws (3) with non-magnetic washers attaching flux valve to bracket (4).

(e) Remove flux valve (2), lifting vertically.

(2) Flux valve 2 (Ref. Fig. 403)

(a) Remove the five screws attaching door 233BT (1) (three lateral screws and two upper screws), and open door.

NOTE : Use non-magnetic wrench

(b) Remove non-magnetic screw (4) with non-magnetic washer holding clamp (5) and flux valve lead (7) and free from bracket (6) (Note position of clamp for installation).

(c) Disconnect connector (8) on flux valve (2) lead.

(d) Remove the four non-magnetic screws (3) with non-magnetic washers attaching flux valve to bracket.

(e) Remove flux valve (2), lifting vertically.

D. Preparation of Replacement Component

(1) Make certain that flux valve is in good external condition.

(2) Make certain that compensation screws (9) are tight.

(3) Place clamp (5) on lead (7) (lead clamp from removed component).

E. Install

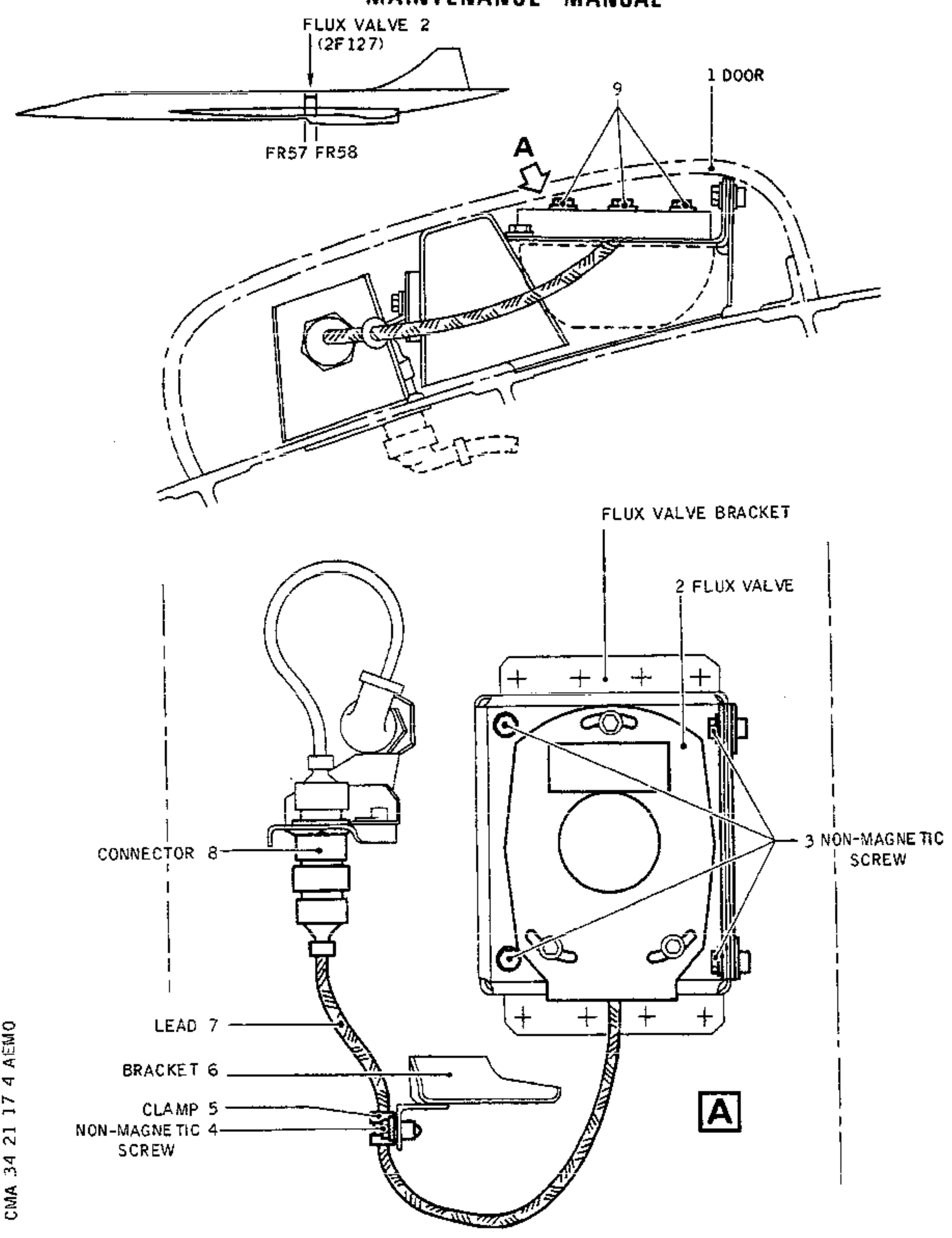
**ON A/C 002-002,

(1) Flux valve 1 (Ref. Fig. 401)

(a) Position flux valve (2) on its bracket.

NOTE : Use non-magnetic wrench.

(b) Install the four non-magnetic screws (3) with



Flux Valve 2 - Removal/Installation
Figure 403

R

non-magnetic washers and tighten.

(c) Connect connector (8).

(d) Position clamp (5) with non-magnetic screw (4) and non-magnetic washer on bracket (6) and tighten screw (Adjust lead (7) in clamp if necessary).

R After SB 34-021 For A/C 002-002,

(1) Flux valve 1 (Ref. Fig. 402)

(a) Position flux valve (2) on its bracket (4).

NOTE : Use non-magnetic wrench.

(b) Install the four non-magnetic screws (3) with non-magnetic washers and tighten.

(c) Connect connector (8).

(d) Position clamp (5) with non-magnetic screw (6) and non-magnetic washer on flux valve bracket (4) and tighten screw (Adjust lead (7) in clamp if necessary).

(2) Flux valve 2 (Ref. Fig. 403)

(a) Position flux valve (2) on its bracket.

NOTE : Use non-magnetic wrench.

(b) Install the four non-magnetic screws (3) with non-magnetic washers and tighten.

(c) Connect connector (8).

(d) Position clamp (5) with non-magnetic screw (4) and non-magnetic washer on bracket (6) and tighten screw (Adjust lead (7) in clamp if necessary).

F. Test

(1) Remove safety clips and tags and reset the circuit breakers corresponding to system on which removal/installation was carried out listed in paragraph 2.B.(1).

(2) Carry out operational test Prepare procedure (Ref. 34-21-00, Adjustment/Test, paragraph 1.B.).

(3) On Captain and First Officer instrument panels, check on HSI, RMI/ADF, RMI/VOR indicators that magnetic headings given by the two compass couplers are identical to within 2°.

NOTE : In case of a deviation greater than this, carry out a flux valve compensation (Ref. 34-21-17, Adjustment/Test).

(4) Carry out operational test close-up procedure. (Ref. 34-21-00, Adjustment/Test, paragraph 1.D.).

G. Close-Up

(1) Close access door 231AT (for flux valve 1) or 233BT (for flux valve 2).

(2) Install and tighten the five attachment screws.

(3) Remove access platform.

FLUX VALVE - ADJUSTMENT/TEST

1. General

The flux valves are pre-indexed and the adjustment to be made on the aircraft consists of compensation intended to reduce effects of distortion of the earth's magnetic field caused by aircraft structure and electrical systems.

RB A compass check swing must be carried out as detailed in
RB para.2.A., B., C., D.(3) and E. in the following circumstances.

RB A. Whenever inaccuracies are reported, unless the cause of the
RB inaccuracy is a system defect identified and confirmed by
RB trouble shooting and after rectification, the difference
RB between numbers 1 and 2 compass headings is less than 1
RB degree.

RB B. After modification, repair or major replacement involving
RB magnetic materials in the vicinity of the standby compass,
RB as defined by Technical Services.

RB C. If inaccuracy is suspected after the compass systems have
RB been subjected to shock, i.e. heavy landing.

RB D. If inaccuracy is suspected after the aircraft has passed
RB through an electrical storm or been struck by lightning.

RB E. After the aircraft has remained on the same heading for
RB three months.

RB If compass deviation d is greater than the +/-1 degree
RB tolerance stated, at any heading checked, carry out the full
RB compensation procedure (para.2.A, B., C., D. & E.).

2. Flux Valve Compensation

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	-
Electronic Voltmeter	-
Access Platform, 3.220 m (10 ft. 7 in.)	-
Tractor	-
Three Ground Service Telephones	-
Compensation Chart	-

B. Prepare

(1) Position aircraft on compensation base (free of metallic masses) by means of the tractor.

(2) Place access platform in working area.

(3) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(4) Switch on electronics rack ventilation system and make certain that it is in operation (Ref. 21-21-00).

(5) Make certain that no foreign metal object is in flux valve zone of magnetic influence.

C. Check

(1) Switch-on of systems.

All systems must be in operation, as well as crew and passenger lighting (See appropriate chapters).

In particular:

(a) Switch on compass couplers 1 and 2 (Ref. 34-21-00).

(b) Switch on INS1, 2 and 3 (Ref. 34-45-00).

(c) At Flight Engineer panel, zone 8-214

(c1) On INS1 MSU (1F12) INS2 MSU (2F12) and INS3 MSU (3F12), place selector switches in NAV position.

(c2) On compass coupler control panel (F125), place both DG/MAG switches in MAG position.

(d) On panel 5-211, place Captain and First officer RAD/INS switches (1F25) and (2F25) in RAD position.

(e) On Captain instrument panel 2-211

(e1) Place COMP selector switch (1F33) in COMP1 position.

(e2) Place ATT INS selector switch (1F7) in ATT INS1 position.

(f) On First Officer instrument panel 2-212

(f1) Place COMP selector switch (2F133) in COMP2 position.

(f2) Place ATT INS selector switch (2F7) in ATT INS2 position.

(g) On centre console

(g1) On panel 7-211, on CDU1 (1F11) and CDU2 (2F11) place selector switches in HDG DA position.

(g2) On panel 9-211, on CDU3 (3F11), place selector switch in HDG DA position (Ref. 34-45-00).

D. Compensation

(1) Deviation calculation d (or compass error).

Deviation d is obtained by taking difference mH-cH. mH is reference magnetic heading obtained by taking the algebraic sum of present position magnetic variation and of true heading given by the inertial navigation system and read in CDU LH window.

Reminder: East variation positive, West variation negative.

cH is compass heading read on Captain or First Officer HSI in MAG mode, and on Captain or First Officer RMI/ADF, RMI/VOR.
Note mH reference values, cH values and deviation d on compensation chart (Ref. Fig. 501).

NOTE: Always turn aircraft in the same sense and direct it by means of Captain HSI.

At each heading, make certain before reading HSI that synchronisation indicator on compass coupler control panel is properly centred.

(2) 1st Turn: Flux valve compensation by means of electronic compensators (4 point swing).

(a) Position access platform (zone 123) and open access door 123AB giving access to electronic compensators.

(b) Connect electronic voltmeter

(b1) On flux valve 1 compensator (1F129)

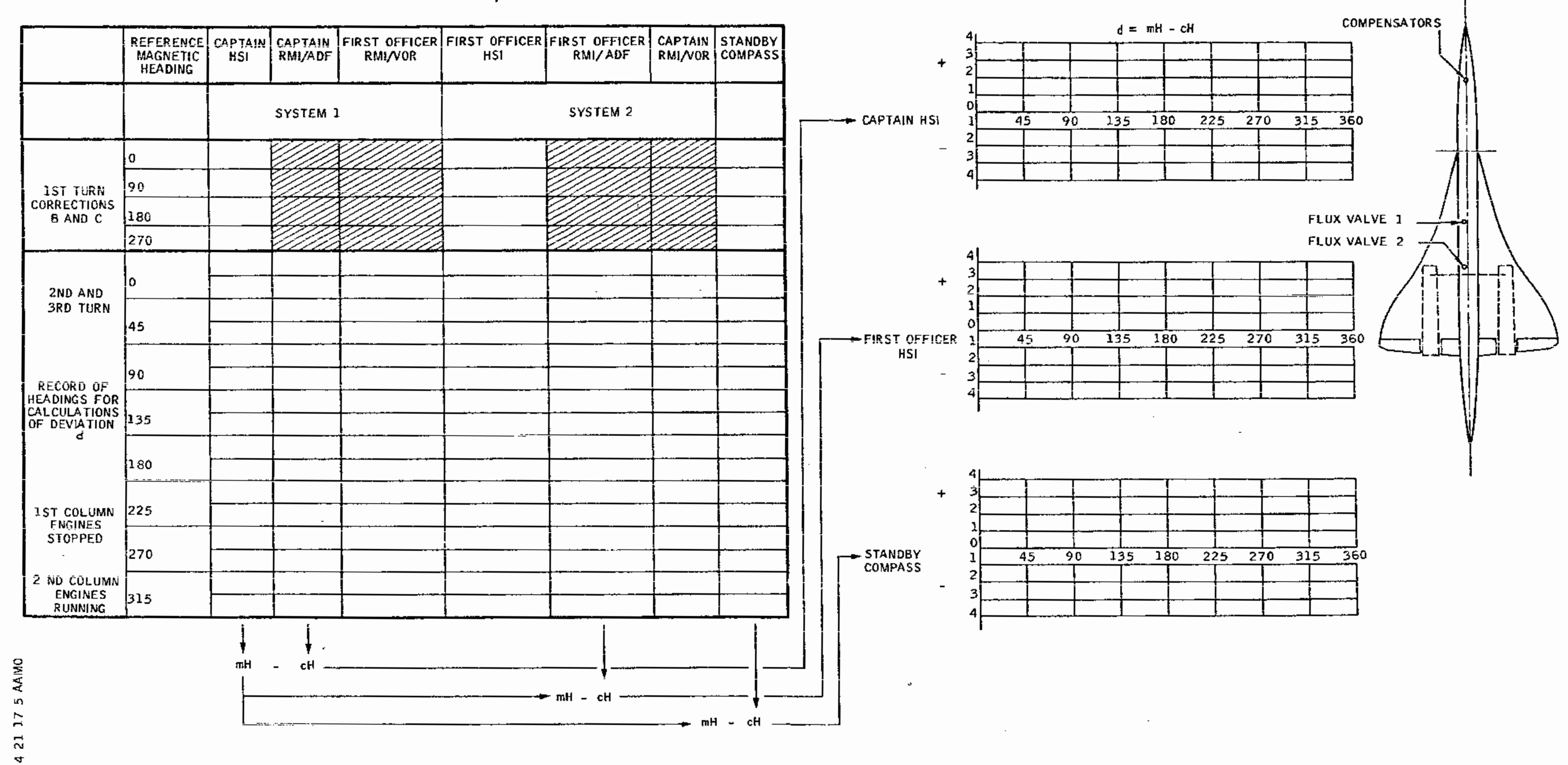
- to N-S test points (TP3) and common (TP1) and adjust appropriate potentiometer to obtain zero voltage.
- to E-W test points (TP2) and common (TP1) and adjust appropriate potentiometer to obtain zero voltage.

(b2) On flux valve 2 compensator (2F129)

- to N-S test points (TP3) and common (TP1) and adjust appropriate potentiometer to obtain zero voltage.
- to E-W test points (TP2) and common (TP1) and adjust appropriate potentiometer to obtain zero voltage.

(c) Connect a ground service telephone to telephone jack (R76) zone 123, a second telephone to inter-

Continued on Page 507



R

Compensation Chart
Figure 501

R phone box (R75) on nose gear and link to tractor, connect a third telephone in flight compartment.

R (d) Direct aircraft to 000-N. (North) heading

R (d1) Note true heading on CDU and calculate refe-
R rence mH.

R (d2) Note cH on Captain and First Officer HSI

(d3) Connect electronic voltmeter to N-S test
R point and common on compensator (1F129).

(d4) Adjust appropriate N-S potentiometer screw to zero total error on Captain HSI (compensation C).

(d5) On compass coupler SYS1 control panel (F125)
R place DG-MAG selector switch in DG position.

(d6) Return selector to MAG position.
R Wait at least 1 minute and read cH on Captain HSI.

R (d7) In case of a further difference from mH, again adjust N-S potentiometer screw.

NOTE : Scale of compensation of N-S and E-W potentiometers, with aircraft in a standard horizontal magnetic field of 0.18 oersted, is as follows : one turn of potentiometer screw equals an error correction of 4 to 6 degrees.

(d8) Connect electronic voltmeter to N-S test
R point and common on compensator (2F129).

(d9) Adjust appropriate N-S potentiometer screw
R to zero total error on First Officer HSI (Compensation C).

(d10) On compass coupler SYS2 control panel place DG/MAG selector switch in DG position.

(d11) Return selector to MAG position.
R Wait at least 1 minute and read cH on First Officer HSI.

R (d12) In case of a further difference from mH, again adjust N-S potentiometer screw.

(e) Direct aircraft to 090-E (East) heading.

R (e1) Note true heading on CDU and calculate reference mH.

R (e2) Note cH on Captain and First Officer HSI.

R (e3) Connect electronic voltmeter to E-W test point and common on compensator (1F129).

(e4) Adjust appropriate E-W potentiometer screw to zero total error on Captain HSI (compensation B).

(e5) On compass coupler SYS1 control panel, place DG-MAG selector switch in DG position.

R (e6) Return selector to MAG position. Wait at least 1 minute and read cH on Captain HSI.

R (e7) In case of a further difference in mH, again adjust E-W potentiometer screw.

(e8) Connect electronic voltmeter to E-W test point and common on compensator 2F129.

(e9) Adjust appropriate E-W potentiometer screw to zero total error on First Officer HSI (Compensation B).

(e10) On compass coupler SYS2 control panel, place DG-MAG selector switch in DG position.

R (e11) Return selector to MAG position. Wait at least 1 minute and read cH on First Officer HSI.

R (e12) In case of a further difference from mH, again adjust E-W potentiometer screw.

(f) Direct aircraft to 180-S (South) heading.

R (f1) Note true heading on CDU and calculate reference mH.

R (f2) Note cH on Captain and First Officer HSI.

R (f3) Connect electronic voltmeter to N-S test point and common on compensator (1F129).

(f4) Adjust appropriate N-S potentiometer to reduce by half captain HSI error (Compensation C). Note cH obtained. R

(f5) On compass coupler SYS1 control panel, place DG-MAG selector switch in DG position.

(f6) Return selector to MAG position. Wait at least 1 minute and read cH on Captain HSI. R

(f7) In case of difference from previous cH (f4), again adjust N-S potentiometer screw to reduce this difference by half. R

(f8) Connect electronic voltmeter to N-S test point and common on compensator (2F129). R

(f9) Adjust appropriate N-S potentiometer screw to reduce by half First Officer HSI error (Compensation C). Note cH obtained. R

(f10) On compass coupler SYS2 control panel place DG-MAG selector switch in DG position.

(f11) Return selector to MAG position. Wait at least 1 minute and read cH on First Officer HSI. R

(f12) In case of a difference from previous cH (f9), again adjust N-S potentiometer screw to reduce this difference by half. R

(g) Direct aircraft to 270-W (West) heading. R

(g1) Note true heading on CDU and calculate reference mH. R R

(g2) Note cH on Captain and First Officer HSI. R

(g3) Connect electronic voltmeter to E-W test point and common on compensator (1F129). R

(g4) Adjust appropriate E-W potentiometer screw to reduce by half Captain HSI error (Compensation B). Note cH obtained. R

(g5) On compass coupler SYS1 control panel, place DG-MAG in DG position.

(g6) Return selector to MAG position.

R Wait at least 1 minute and read cH on Captain HSI.

R (g7) In case of a difference from previous cH (g4) again adjust E-W potentiometer screw to reduce this difference by half.

(g8) Connect electronic voltmeter to E-W test
R point and common on compensator (2F129).

(g9) Adjust appropriate E-W potentiometer to reduce by half First Officer HSI error
R (Compensation B). Note cH obtained.

(g10) On compass coupler SYS2 control panel, place DG-MAG selector in DG position.

(g11) Return selector to MAG position.
R Wait at least 1 minute and read cH on Captain HSI.

R (g12) In case of a difference from previous cH (g9) again adjust E-W potentiometer screw to reduce this difference by half.

(3) 2nd turn - Check of compensation with engines stopped.

(a) Direct aircraft in 45° steps to cardinal and intermediate points :

R 000 (N) - 045 - 090 (E) - 135 - 180 (S) - 225 - 270 (W) - 315.

At each heading :

R (a1) Note cH on Captain and First Officer HSI and calculate deviation d.

Value of d (for each heading) must be between ± 1°.

(a2) Note values on Captain and First Officer
R RMI/ADF and RMI/VOR.

(b) Switch off all systems and lighting (Ref. appro-
R priate chapters). In particular
R
R (b1) Switch off INS 1, 2 and 3 (In zone 8-214, place INS1 MSU, INS2 MSU and INS3 MSU selector switches in OFF position). (Ref. 34-45-00).

(c) Switch off electronics rack ventilation system. (Ref. 21-21-00).

R
R (d) Uncouple tractor.

(4) 3rd turn - Check of compensation with engines running.

(a) Start up the four engines (Ref. start up procedure).

(b) Switch on electronics rack ventilation system (Ref. 21-21-00).

R (c) Switch on systems (Ref. paragraph 2. C. (1)).

(d) Direct aircraft in 45° steps to cardinal and intermediate points :

000 (N) - 045 - 090 (E) - 135 - 180 (S) - 225 - 270 (W) - 315.

At each heading :

(d1) Calculate and note value of d for Captain and First Officer HSI. Value of d (for each heading) must be between ± 1°.

R (d2) Note cH on Captain and First Officer RMI/ ADF and RMI/VOR.

(e) Using voltmeter, measure voltages at N-S and E-W test points on the two compensators.

(f) Mark these voltages on corresponding VOLTS DC
R labels on compensator front panels.

E. Close-Up

(1) Switch off all systems and lighting (Ref. appropriate
R chapters). In particular
R
R (a) Switch off INS1, INS2 and INS3 (In zone 8-214, place INS1 MSU, INS2 MSU and INS3 MSU selector
R switches in OFF position). (Ref. 34-45-00).

(2) Switch off electronics rack ventilation system. (Ref. 21-21-00).

(3) Shut down the four engines (Ref. shut down procedure).

(4) Disconnect electronic voltmeter.

(5) Disconnect ground service telephones.

R (6) Close access door 123AB and remove access platform.

FLUX VALVE COMPENSATOR - REMOVAL/INSTALLATION

1. General

The flux valve compensators provide remotely a simple correction cycle to neutralize the effects of the aircraft's magnetic field in the region of the flux valves.
Two identical flux valve compensators (1F129 and 2F129) are installed on shelf 12-123 in the forward underfloor equipment compartment in zone 123.
Removal/installation of one compensator only is described.

2. Compensator - Flux Valve

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps	
Access Platform - 11 ft. 4 in. (3.47 m)	

B. Prepare

(1) Trip, safety and tag those of the following circuit breakers associated with the system where removal/ installation is to be carried out :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYS 1 SW SUP	1-213	1F 134	F14
COMPASS COUPLER 1 SUP	2-213	1F 130	F 8
COMPASS COUPLER 2 STBY SUP	13-215	2F 131	B 7
COMPASS COUPLER 2 NORM SUP	13-216	2F 130	D15
COMPASS COUPLER SYS 2 SW SUP	15-216	2F 134	A21

(2) In zone 123, position access platform and open access door 123BB.

C. Remove (Ref. Fig. 401)

(1) Note value of correction voltages indicated on placards (6) and (8) on front face of compensator (9).

NOTE : If these values are not noted, a complete new compensation of the aircraft must be carried out.

(2) Loosen, but do not remove, the two bolts (7).

(3) Hold compensator (9) in position in its seating (1) and remove bolts (7) with washers (5).

(4) Free compensator and remove from mounting bracket (2).

(5) Disconnect connector (3) from rear connector (4) on compensator.

(6) Cap connectors (3) and (4).

D. Preparation of Replacement Component

(1) Make certain that mounting bracket is clean and that aircraft connector and electrical wiring are in correct condition.

(2) Make certain that outside of compensator is in good condition, and that there are no traces of oxidation on rear connector.

(3) Make certain that NS and EW placards are installed on compensator.

E. Install (Ref. Fig. 401)

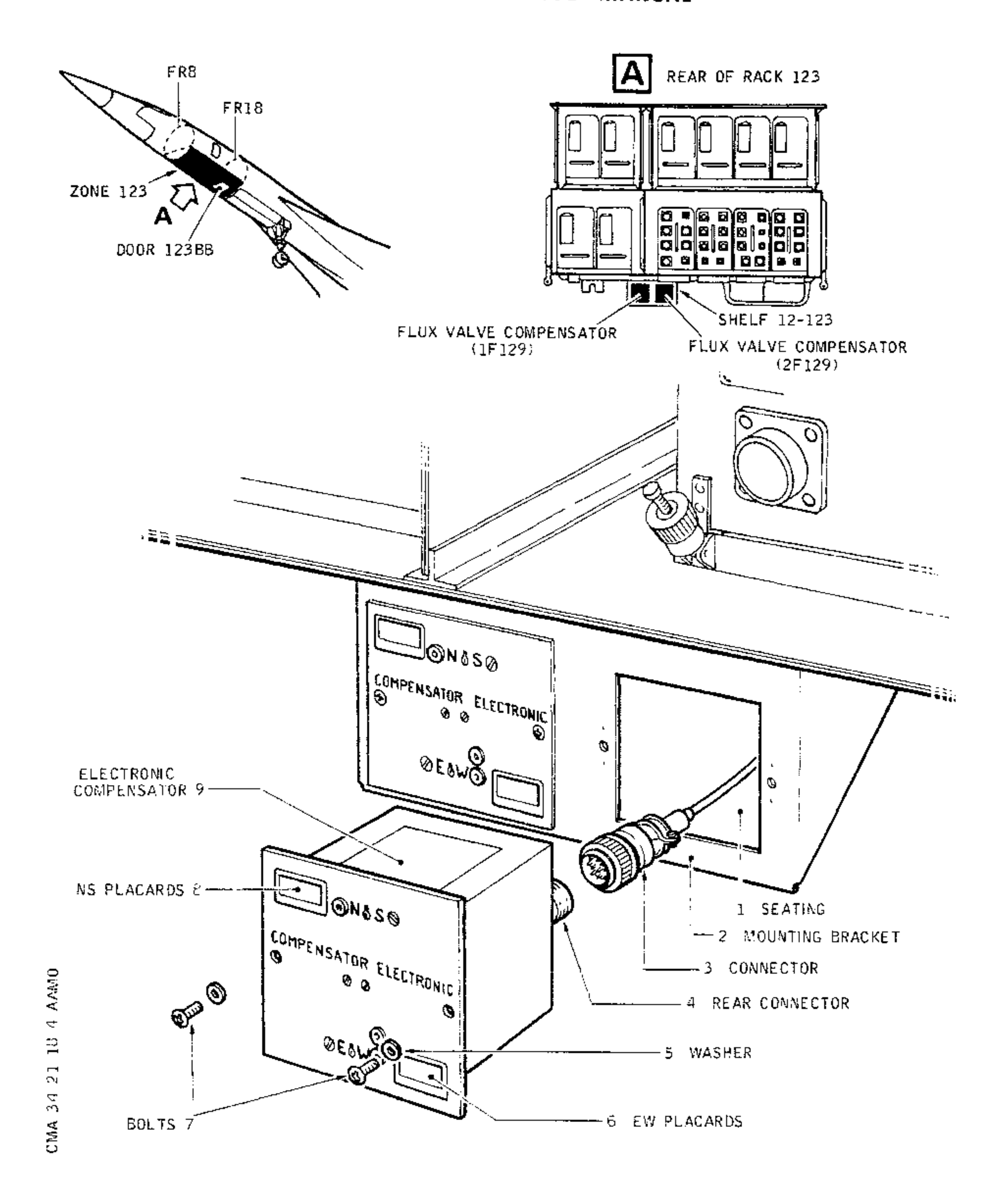
(1) Remove blanking caps from connectors (3) and (4).

(2) Position compensator (9) in front of seating (1) and connect connector (3) to rear connector (4).

(3) Engage and hold compensator in correct position in mounting bracket.

(4) Install washers (5) and bolts (7), tighten bolts.

(5) On placards (6) and (8), mark values of voltages noted from compensator previously removed (See step 2. C.



Flux Valve Compensator - Removal/Installation
Figure 401

(1)).

F. Close-Up

(1) Adjust correction voltages of compensator (Ref. 34-21-18, Adjustment/Test).

(2) Close access door 123BB and remove access platform.

FLUX VALVE COMPENSATOR - ADJUSTMENT/TEST

1. General

Adjustment of correction voltage values for replacement flux valve compensator to equal values for removed flux valve compensator.

2. Compensator - Flux Valve

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform 11 ft. 4 in. (3.47 m)	
Electronic Voltmeter	
Electrical Ground Power Unit	

B. Prepare

(1) Remove safety clips and tags and trip those of the following circuit breakers corresponding to system on which work is to be carried out :

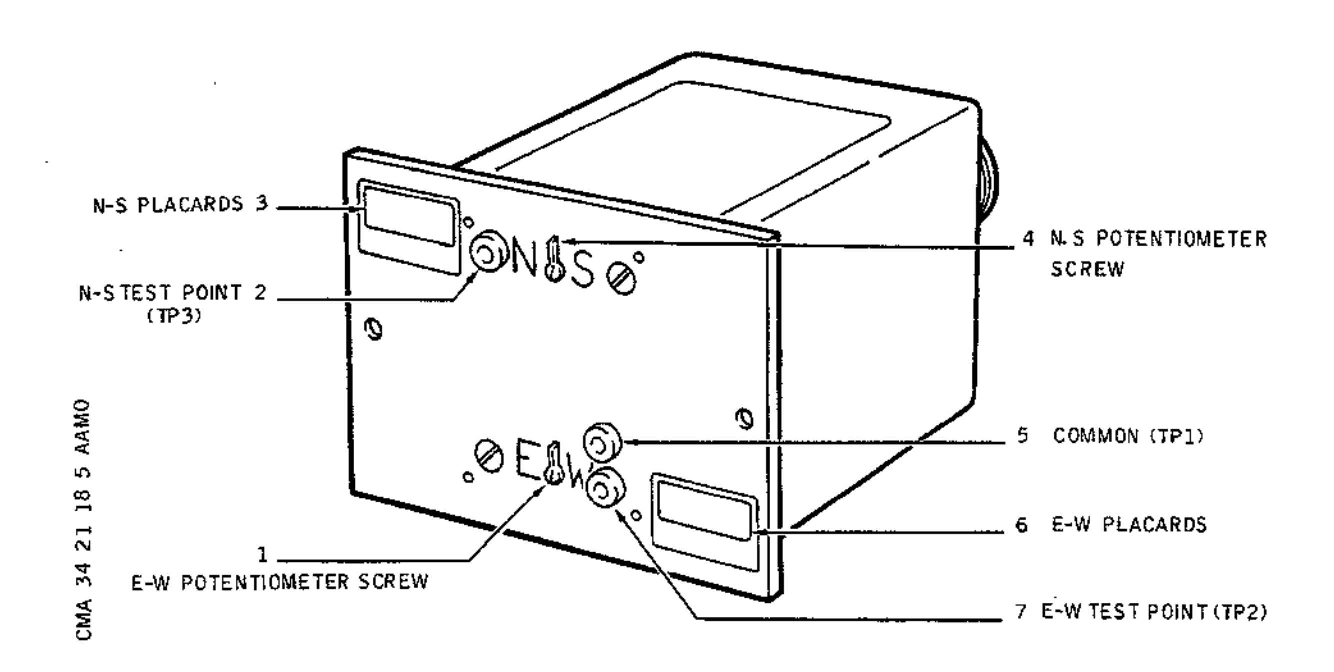
SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYS1 SW SUP	1-213	1F 34	F14
COMPASS COUPLER 1 SUP	2-213	1F 130	F 8
COMPASS COUPLER 2 STBY SUP	13-215	2F 131	B 7
COMPASS COUPLER 2 NORM SUP	13-216	2F 130	D15
COMPASS COUPLER 2 SW SUP	15-216	2F 134	A21

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) Make certain that access platform is positioned under access door 123BB.

C. Adjustment (Ref. Fig. 501)



Flux Valve Compensator - Measurement Points
Figure 501

(1) Connect electronic voltmeter between test points TP3 (+) (2) and TP1 (-) (5) and note N-S correction voltage.

(2) Adjust N-S potentiometer screw (4) to give voltage marked on N-S placard (3) to within ± 0.1 V and immobilise N-S potentiometer screw.

(3) Connect electronic voltmeter between test points TP2 (+) (7) and TP1 (-) (5) and note E-W correction voltage.

(4) Adjust E-W potentiometer screw (1) to give voltage

marked on E-W placard (6) to within ± 0.1 V and immobilise E-W potentiometer screw.

(5) Check N-S and E-W correction voltages once again, and if necessary re-adjust until voltages remain stable.

D. Close-Up

(1) Disconnect and stow electronic voltmeter.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(4) Carry out removal/installation close-up procedure (Ref. 34-21-18, Removal/Installation).

COMPASS COUPLER SWITCHING UNIT - REMOVAL/INSTALLATION

1. General

Compass coupler 1=2 and 2=1 switching unit is an item of rack-mounted equipment installed on shelf 26-123 in equipment bay F8/F18-LH. This equipment bay can be reached through access door 123BB.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Access Platform, Height of Access 3.46 m (11 ft. 4 in.)	

B. Prepare

(1) Position access platform below equipment bay.

(2) Open equipment bay access door 123BB.

(3) Remove equipment bay forward panel.

(4) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYS 1 SW SUP	1-213	1F 134	F14
ADF 1 IND	2-213	1R 174	C 7
FLT CONT & NAV BUS 14XS		X 355	H 2
HSI MAG 1ST PLT INS 1 SUP & IND		1F 16	B 8
RMI VHF NAV 1 IND		1R 34	C 6
COMPASS COUPLER 1 SUP		1F 130	F 8
APFD SYS 1 SUP	13-215	1C 20	C 5
COMPASS COUPLER 2 STBY		2F 131	B 7

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SUP			
COMPASS COUPLER SYS 2 SW SUP	15-216	2F 134	A21
APFD SYS 2 SUP	13-216	2C 20	A17
ADF 2 IND		2R 174	A18
RMI VHF NAV 2 IND		2R 34	A19
HSI MAG 2ND PLT INS 2 SUP & IND		2F 16	C14
COMP COUPLER 2 NORM SUP		2F 130	D15
NAV INST BUS 13XS		X 345	G 4

(5) On glareshield instrument panel 5-211, place Captain and First Officer RAD INS selector switches in RAD position.

C. Remove Compass Coupler Switching Unit

(1) Gain access to shelf 26-123, LH side.

(2) Unscrew retaining nut on switching unit rack until switching unit securing lug is free.

(3) Swing retaining nut shaft downwards.

(4) Pull gently on handle in order to release rear connectors on switching unit from rack connectors. Withdraw switching unit until completely disengaged from rack slides.

(5) Place blanking caps on connectors.

(a) On rack.

(b) On switching unit.

D. Preparation of Replacement Component

(1) Make certain that rack is clean and that rack connectors are in correct condition.

(2) Visually check replacement component for correct condition. Make certain that connectors are intact, with no trace of corrosion.

E. Install

(1) Remove blanking caps from connectors.

(a) On rack.

(b) On switching unit.

(2) Position switching unit on rack and slide slowly towards the rear making certain that guide pins properly engage in their holes on switching unit.

(3) Continue to push switching unit to engage rear connectors and rack connectors (when switching unit is at stop, switching unit and rack front panels must be flush).

(4) Lift retaining nut shaft, engaging nut with securing lug, and tighten retaining nut until locked.

F. Close-Up

(1) Remove safety clips and tags and reset the circuit breakers tripped in paragraph 2.B. (4)

(2) Carry out a compass coupler switching unit test (Ref. 34-21-00, Adjustment/Test, paragraphs 1.A., 1.B., 1.C. (5)) and D.

(3) Replace equipment bay forward panel.

(4) Replace equipment bay access door 123BB.

(5) Remove access platform.

COMPASS COUPLERS 1F126 & 2F126 - REMOVAL/INSTALLATION

1. General

Compass couplers No.1 1F126 and No.2 2F126 are rack mounted equipment installed on shelf 26-123 in aircraft equipment bays F8/F18.
Access to equipment bays is gained through access door 123BB.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Access Platform, Height of Access 3.46m (11ft.4in.)	

B. Prepare

(1) Position access platform under equipment bays.

(2) Open equipment bay access door 123BB.

(3) Remove relevant access panel.

(4) On glareshield instrument panel 5-211, place Captain and First Officer RAD-INS selector switches in INS position.

(5) On Captain and First Officer instrument panels place COMP1/COMP2 switches in COMP1 and COMP2 positions respectively.

(6) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
HSI MAG 1ST PLT INS1 SUP & IND	2-213	1F 16	B 8
ADF1 IND		1R 174	C 7
FLT CONT & NAV BUS 14 XS		X 355	H 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RMI UHF NAV1 IND		1R 34	C 6
COMPASS COUPLER 1 SUP		1F 130	F 8
APFD SYS1 SUP	13-215	1C 20	C 5
COMPASS COUPLER2 STBY SUP		2F 131	B 7
APFD SYS2 SUP	13-216	2C 20	A17
ADF2 IND		2R 174	A18
RMI VHF NAV2 IND		2R 34	A19
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
COMPCOUPLER2 NORM SUP		2F 130	D15
NAV INST BUS 13 XS		X 345	G 4

C. Remove Compass Coupler No.1

(1) Gain access to shelf 26-123, RH side.

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.D.(1).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.F.(1).

F. Remove/Install Compass Coupler No.2

(1) Gain access to shelf 26-123, LH side.

(2) Repeat steps 2.C., D. and E above

G. Test

(1) Remove safety clips and tags and reset the circuit breakers tripped in paragraph 2.B.(6).

(2) Carry out a compass coupler operational test, Ref. 34-21-00, Adjustment/Test Compass Coupler No.1 : paragraphs 1.A, 1.B, 1.C.(1) (a), 1.C.(2) ; Compass

Coupler No.2 : paragraphs 1.A., 1.B., 1.C.(1)(b), 1.C.(3).

H. Close-Up

(1) Refer to 34-21-00, Adjustment/Test, Operationel Test, paragraph 1.D.

(2) Install relevant access panel.

(3) Close equipment bay access door 123BB.

(4) Remove access platform.

COMP1 - COMP2 SWITCH - REMOVAL/INSTALLATION

1. General

Captain COMP1 - COMP2 switch 1F133 is located on Captain instrument panel, panel 2/2 -211.
First Officer COMP1 - COMP2 switch 2F 133 is located on First Officer instrument panel, panel 4/2-212.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1STPLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
DEV1 & DEV2 1STPLT SW SUP		1R 38	G14
ATT/INS 1STPLT SW SUP		1F 13	G16
RAD/INS 1STPLT SW SUP		1F 26	G17
COMPASS COUPLER SYS2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV1 & DEV2 2ND PLT SW SUP		2R 38	F21

C. Remove COMP1 - COMP2 switch

(1) Refer to 33-16-00, Removal/Installation, for electroluminescent (EL) panel.

(2) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

D. Preparation of Replacement Component

Not applicable

E. Install

(1) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

(2) Refer to 33-16-00, Removal/Installation, for EL panel.

F. Tests

(1) Refer to 33-10-00, Adjustment/Test, Close-Up for typical toggle switch.

(2) Check switch operation by carrying out COMP1 - COMP2 switch test procedures (Ref. 34-21-00, Adjustment/Test, Operational Test, paragraphs 1.A., 1.B., 1.C., (5)).

(3) Refer to 33-16-00, Removal/Installation, paragraph 2.G. (1) through (5) for EL panel.

G. Close-Up

(1) Refer to 34-21-00, Adjustment/Test, Operational Test, Paragraph 1.D.

STANDBY HORIZON - DESCRIPTION AND OPERATION

1. General

The standby horizon system is designed to provide the pilot with a true vertical reference, thus enabling him to check the aircraft attitude and manoeuvers against roll and pitch angle indications displayed on the face of an indicator.
A static inverter provides power for the indicator.

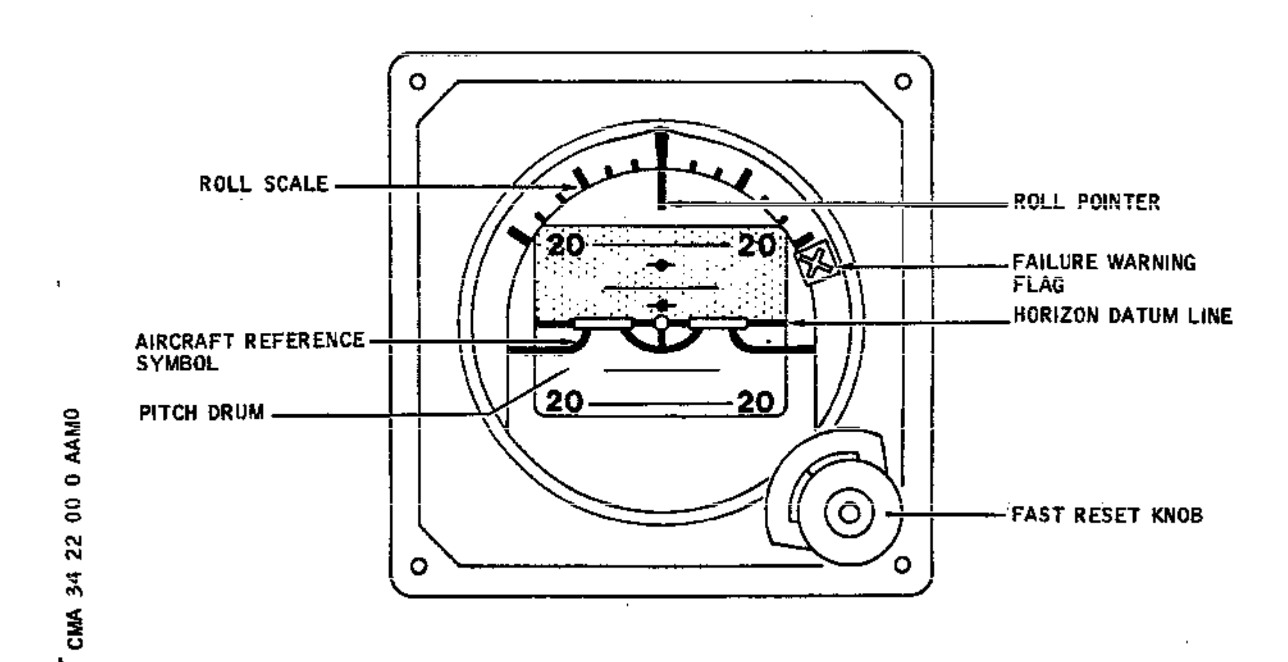
2. System Components

The standby horizon system comprises :

- An indicator (F120)
- A static inverter (F122)

3. Description

R B A. Gyro Horizon=SFENA 705=7V91 or 705-7V91BA (Ref. Fig. 001)



Gyro Horizon : Front View
Figure 001

The standby horizon indicator consists of a gyroscope rotating at very high speed (approximately 2000 RPM) about its centre of gravity within two gimbals perpendicular to each other.
One gimbal transmits pitch indications and the other roll indications.
The instrument power supply is 115 VAC, 400 Hz.

(1) On the circular dial face are :

(a) On the upper section, a roll scale graduated in 10° intervals up to 60° right and left of a 0° centre mark.
A roll pointer linked to the movement of the drum moves across the scale.

(b) A drum divided into two colour zones, separated by a horizon datum line, indicates pitch angle.
From the datum line, each zone is marked with a graduated scale.
The light colour, or nose up zone is marked as follows :

- A scale marked at 20°, intervals up to 80°
- Unnumbered markers at 10° and 30°
- A dot intersected by a short line at + 5° and + 15°
- The word UP is marked at the + 40° + 60° and + 80° points.

The dark colour, or nose down zone is marked as follows :

- A scale marked at 20° intervals up to 80° (This value is never reached because of a stop at 73°)
- An intermediate marker at - 10°
- The word DOWN is marked at the - 40°, - 60° and - 80° points.

The scale units for nose up and nose down attitudes are marked by matt black bands on a red fluorescent background.

(c) A reference aircraft symbol is positioned at the centre of the face.

(d) A fast reset knob, located at the lower RH corner enables :

- By pulling the knob, resetting of the gyro to

a mean value.

(e) On the right, a failure warning flag marked with a matt white cross on a red fluorescent background appears when a failure is detected. It is not visible during normal operation.

(2) An electrical connector on the instrument rear panel connects to the aircraft electrical network.

B. Static Inverter - SFENA TSG420-101

The static inverter is contained in a rectangular case, and is designed to supply an output voltage of 115 VAC, 400 Hz from a 28 VDC input. It is of solid state construction, no rotary elements are used.
An electrical connector on the front panel connects to the aircraft electrical network.
Cooling fins are fitted to each side of the case.

4. <u>Operation</u> (Ref. Fig.002 and 003)

A. Gyro Horizon

(1) Aircraft in straight and level flight.

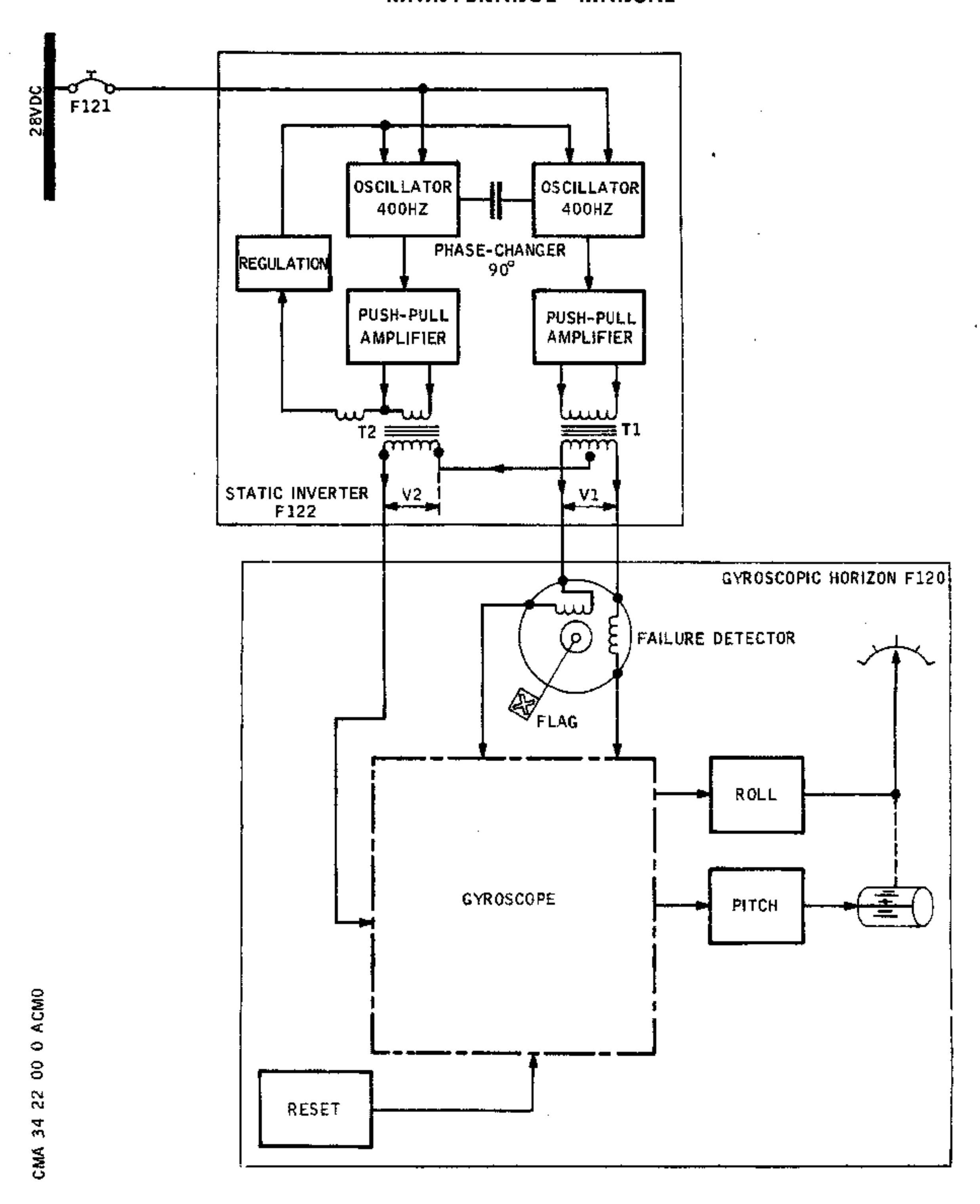
When the aircraft is in straight and level flight, the horizon datum line on the drum is coincident with the zero marker and the central point of the reference symbol.
This configuration indicates zero pitch on the drum and zero roll on the roll pointer.

(2) Aircraft Manoeuvering

When the aircraft is in a nose up or nose down attitude
R a gyroscope reaction results, the drum, being slaved
R to the gyroscope, makes a corresponding movement,
causing it to display the colour zone appropriate to the longitudinal attitude. The pitch angle is indicated by the position of the centre point of the reference symbol on the drum graduated scale.
For roll manoeuvers, since the drum spindle is fixed to the roll gimbal, roll angles are given in magnitude and sign by the position of the reference symbol relative to the scale lines on the drum, and by the roll scale pointer linked to the drum.

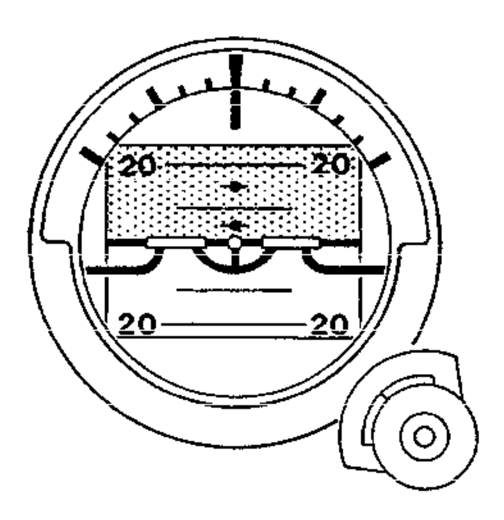
(3) Resetting

In case of drift or disturbance of the gyroscope unit,

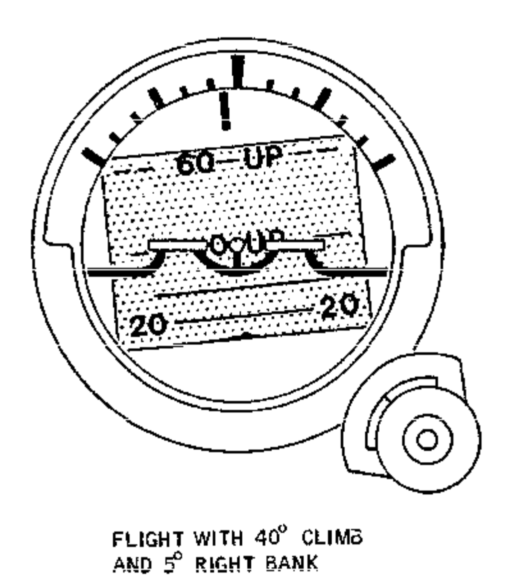


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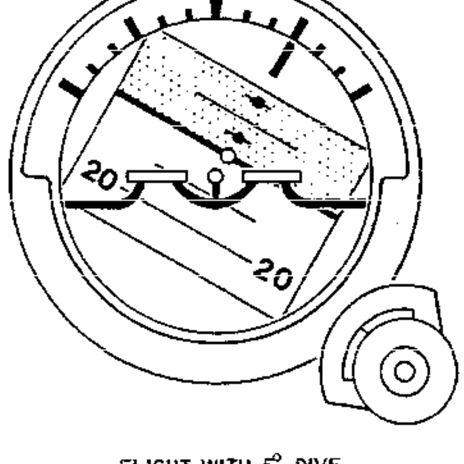
Standby Horizon : Operation Block Diagram
Figure 002



LEVEL FLIGHT



FLIGHT WITH 40° CLIMB
AND 5° RIGHT BANK



FLIGHT WITH 5° DIVE
AND 30° LEFT BANK

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Gyro Horizon : Display Indications
Figure 003

resetting is necessary to return it to an average position value.
This is done by pulling out the fast reset knob at the lower right of the indicator.

NOTE : Resetting should be carried out each time the device is switched on.
In flight, the procedure should be carried out in straight and level flight.

(4) Flight using reference symbol

R Flight using the reference aircraft symbol facilitates
R holding of a constant attitude. This procedure consists of maintaining the horizon datum line coinci-
R dent with the reference symbol.
Thus in descent, climb or turn configurations, the pilot knows the pitch or roll angle.

(5) Warning

A failure warning flag appears when a fault is detected.

This device consists of a two-phase motor connected in series with two of the windings of the gyroscope stator.
In case of a failure or under-voltage in one phase of the power supply, the torque becomes smaller than the force of an opposing spring, which results in the appearance of the failure warning flag.

R NOTE : When a fault is detected, the gyro horizon remains useable for approximately 5 minutes.

B. Static Inverter

The 28 VDC power supplied from essential bar A is sent to the static inverter through circuit breaker F121.
This voltage is applied to two timed oscillators interconnected through a 90° phase-changer. Each oscillator sends an alternating signal to a push-pull amplifier. The amplified signals with a phase-difference of 90° are applied to two output transformers (T1) and (T2) of which the centre tap of the secondary winding of one (T1) is connected to the input of the secondary winding of the other (T2).
At the output of the inverter, a three-phase voltage of 115 Volts amplitude is produced, with a 120° phase difference between phases.
Output voltage regulation is achieved by a negative feedback circuit which regulates the input level of each oscil-

lator. The output voltage of the inverter is supplied to the gyro horizon.

STANDBY HORIZON - TROUBLE SHOOTING

WARNING : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified.
The defect can be isolated with the aid of trouble shooting procedures and traced through OK and not OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification.

2. Prepare

A. On panel 1-213, make certain that circuit breaker STBY HORIZON IND (F121), position H16, is set.

B. Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

C. Switch on electronics rack ventilation system (Ref. 21-21-00).

D. Panel 2-211, on standby horizon remove safety pin from fast reset knob at lower right of indicator as follows :
- gently pull fast reset knob
- remove and retain safety pin
- gently release knob

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3. Trouble Shooting

```
*****************************************************
* On panel 2-211, check that flag X has disappeared *
* On standby horizon [1]. IF                        *
*****************************************************
   ||     |          ------------------------------------------------
   ||     |          | Flag X appears on standby horizon.            |
   OK    NOT OK---| Ref. Chart 101.                               |
   ||                ------------------------------------------------
*****************************************************
* Pull out fast reset knob, hold out until horizon  *
* datum line on drum is facing orange markers.      *
* (Attitude 0°). IF                                 *
*****************************************************
   ||     |          ------------------------------------------------
   ||     |          | Horizon datum line on drum does not position  |
   ||     |          | facing orange markers.                        |
   ||     |          | Trip circuit breaker [2].                     |
   OK    NOT OK---| Install safety pin on fast reset knob, replace |
   ||                | Standby horizon [1].                          |
   ||                ------------------------------------------------
*****************************************************
* After approximately 2 minutes, release fast reset *
* knob. Check that drum is positioned correctly with*
* respect to aircraft attitude. IF                  *
*****************************************************
   ||     |          ------------------------------------------------
   ||     |          | Drum does not indicate aircraft attitude.     |
   ||     |          | Trip circuit breaker [2].                     |
   OK    NOT OK---| Install safety pin on fast reset knob, replace |
   ||                | Standby horizon [1].                          |
   ||                ------------------------------------------------
*****************************************************
* Install safety pin on fast reset knob. Standby    *
* horizon system is operational.                    *
*****************************************************
```

```
**************************************-------------------------------
* FLAG X VISIBLE ON STANDBY HORIZON   *| GROUND EQUIPMENT REQUIRED |
**************************************-------------------------------
                                       | DESCRIPTION      PART NO. |
                                       -----------------------------
                                       | MULTIMETER                |
                                       -----------------------------

****************************************************
* Trip circuit breaker [2].                        *
* Install safety pin on fast reset knob and remove *
* Standby horizon [1].                             *
* Reset circuit breaker [2] and check 115VAC 400 Hz *
* three phase power supply on pins A, B and C of   *
* aircraft connector (F120A).                      *
****************************************************
   |     |        ---------------------------------------------
   NO    YES------| Replace standby horizon [1]                |
   |              ---------------------------------------------
---------------------------------------------------
| Check 28VDC at circuit breaker [2] output.       |
---------------------------------------------------
   |     |        ---------------------------------------------
   |     |        | Remove panel 215GS on LH electronics rack.  |
   |     |        | Trip circuit breaker [2].                   |
   NO    YES------| Replace static converter [3].               |
   |              ---------------------------------------------
---------------------------------------------------
| Replace circuit breaker [2].                     |
---------------------------------------------------
```

Chart 101

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] Indicator - Standby Horizon	-	2-211	F120	Flight Compartment	34-22-11 R/I	34-22-11
[2] Circuit breaker 28 VDC	-	1-213	F121	Map Ref. H 16	24-50-00 R/I	34-22-11
[3] Inverter - Static	215GS	1-215	F122	LH electronics Rack	34-22-12 R/I	34-22-11

R Component Identification
Table 101

STANDBY HORIZON - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, page 301, S)

(2) Panel 2-211, on standby horizon indicator (F120). Remove locking pin from fast reset knob at lower right of indicator and proceed as follows :

- lightly pull out fast reset knob
- retain locking pin
- gently release knob

(3) Panel 1-213, make certain that following circuit breaker is reset :
STBY HORIZON IND (F121) map. ref H16.

C. Test

(1) On shelf 1-215, make certain that static inverter (F122) is in operation.

(2) Panel 2-211, check on standby horizon indicator (F120) that flag X is not visible.

(3) After thirty seconds of system operation, carry out a fast reset of standby horizon as follows :

(a) Slowly pull out standby horizon fast reset knob at lower right of indicator (F120) and hold until horizon datum line marked on drum is in line with orange markers (0° attitude).

(b) Gently release fast reset knob

(c) Wait approximately five minutes, then check that pitch and roll indications correspond with air-

craft attitude.

(4) On panel 1-213, trip circuit breaker STBY HORIZON IND (F121) map. ref H16 :
- panel 2-211, check on standby horizon indicator (F120) that flag X is visible.

D. Close-Up

(1) Panel 2-211, on standby horizon indicator, replace locking pin in order to hold out fast reset knob.

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, page 301, S)

2. Functional Test

Identical with operational test, refer to paragraph 1.

3. System Test

Identical with functional test, refer to paragraph 2.

STANDBY HORIZON - REMOVAL/INSTALLATION

1. General

The indicator is installed on the Captain main instrument panel (Panel 2-211).

The indicator can be removed directly by withdrawing it forwards as the length of wiring is sufficient.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On Captain instrument panel 12-211, make certain that LH DASH INSTRUMENTS knob is in OFF position.

(2) Make certain on indicator that fast reset knob is held out by the safety pin and that X flag is visible.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ST-BY HORIZON IND	1-213	F 121	H16
LH DASH INS LTS SUP	13-215	L 372	A12

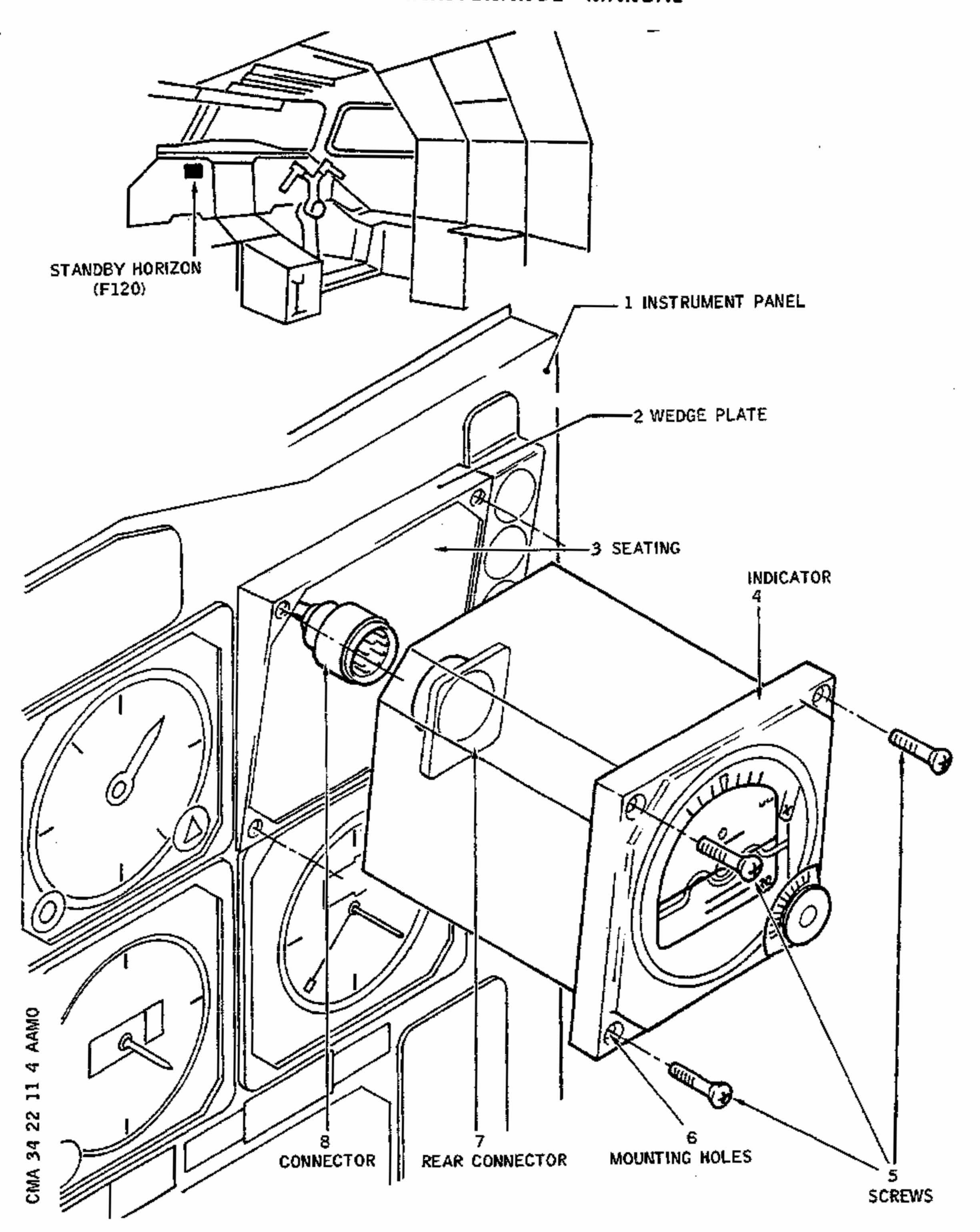
C. Remove (Ref. Fig. 401)

(1) Loosen and remove the three standby horizon indicator (4) mounting screws (5).

(2) Carefully release indicator (4) from its seating (3) and withdraw.

(3) Disconnect aircraft connector (8) from indicator rear

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Removal/Installation of a Standby Horizon Indicator
Figure 401

connector (7).

(4) Cap connectors (7) and (8).

D. Preparation of Replacement Component

(1) Make certain that indicator seating is clean and that aircraft wiring and connectors are in good condition.

(2) Make certain that indicator is in good external condition, that its connector is undamaged and has no trace of corrosion, and that safety pin is in position on fast reset knob.

E. Install
(Ref. Fig. 401)

(1) Removing blanking caps from connectors (7) and (8).

(2) Position indicator (4) facing its seating (3) and connect aircraft connector (8) to indicator rear connector (7).

(3) Engage indicator in seating and push fully against wedge plate (2) attached to instrument panel (1).

(4) Install and tighten the three mounting screws (5) in indicator holes (6).

F. Close-Up

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2. B. (3).

(2) Carry out a standby horizon test (Ref. 34-22-11, Adjustment/Test).

STANDBY HORIZON - ADJUSTMENT/TEST

1. General

This standby horizon test shall be carried out after removal/installation of the standby horizon or of its static inverter.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing)

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

C. Tests

(1) On panel 12-211, adjust LH DASH INSTRUMENTS potentiometer to obtain correct illumination of indicator face.

(2) On panel 2-211, on standby horizon, remove safety pin from fast reset knob and check that X flag is not visible.

(3) Slowly pull out fast reset knob until horizon datum line is facing orange markers (0° attitude).

(4) Gently release fast reset knob, wait approximately 4 or 5 minutes and check that pitch and roll indications correspond with aircraft attitude.

(5) Install safety pin on fast reset knob.

D. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00,

Servicing).

STATIC INVERTER - REMOVAL/INSTALLATION

1. General

The static inverter (F122) is installed in LH electronics rack, shelf 1-215.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	

B. Prepare

(1) Trip, safety and tag circuit breaker ST BY HORIZON IND, panel 1-213 (F121), map ref. H16.

(2) On LH electronics rack, remove panel 215GS to gain access to shelf 1-215.

C. Remove

(1) Disconnect aircraft connector from static inverter connector.

(2) Cap connectors.

(3) Remove the four screws attaching static inverter to its mounting plate.

(4) Remove static inverter from shelf.

D. Preparation of Replacement Component

(1) Visually check static inverter for correct condition. Make certain that connector has no traces of corrosion.

(2) Make certain that aircraft connector and wiring are in correct condition.

E. Install

(1) Position static inverter on mounting plate on shelf.

(2) Install the four screws attaching static inverter to its mounting plate and tighten.

(3) Remove blanking caps from connectors.

(4) Connect aircraft connector to static inverter connector.

F. Tests

(1) Remove safety clips and tags and reset circuit breaker tripped in paragraph 2.B.(1).

(2) Carry out a standby horizon test (Ref. 34-22-11, Adjustment/Test).

G. Close-Up

(1) On LH electronics rack, install panel 215GS.

END OF THIS SECTION

NEXT

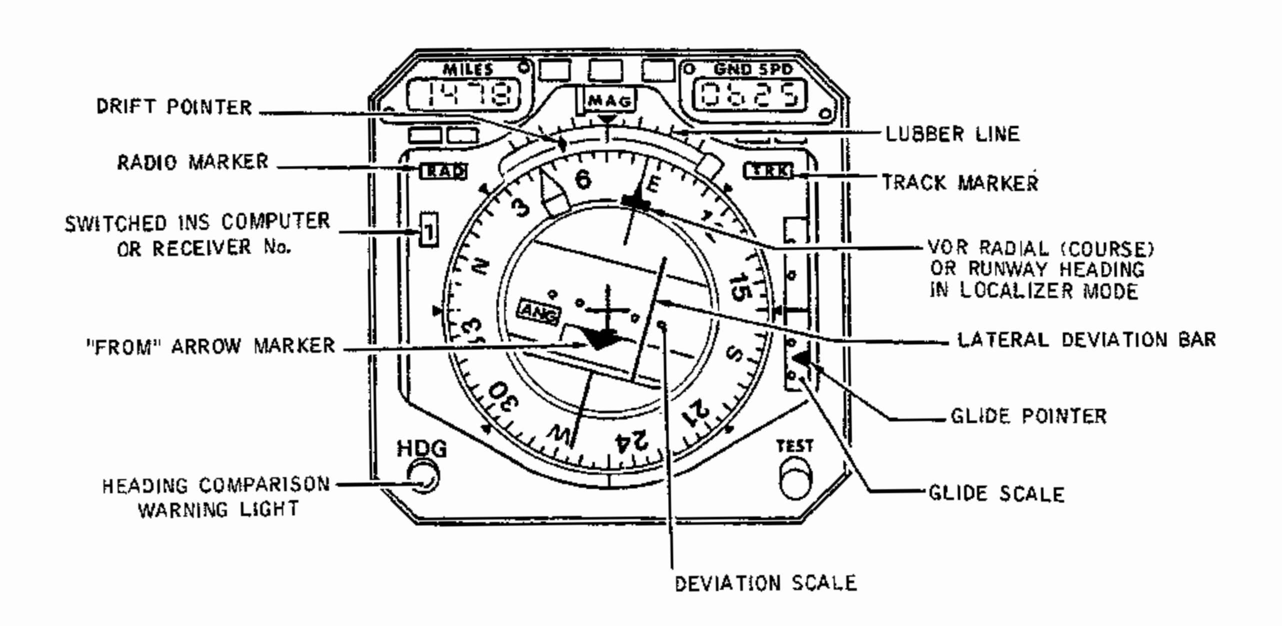
1. General

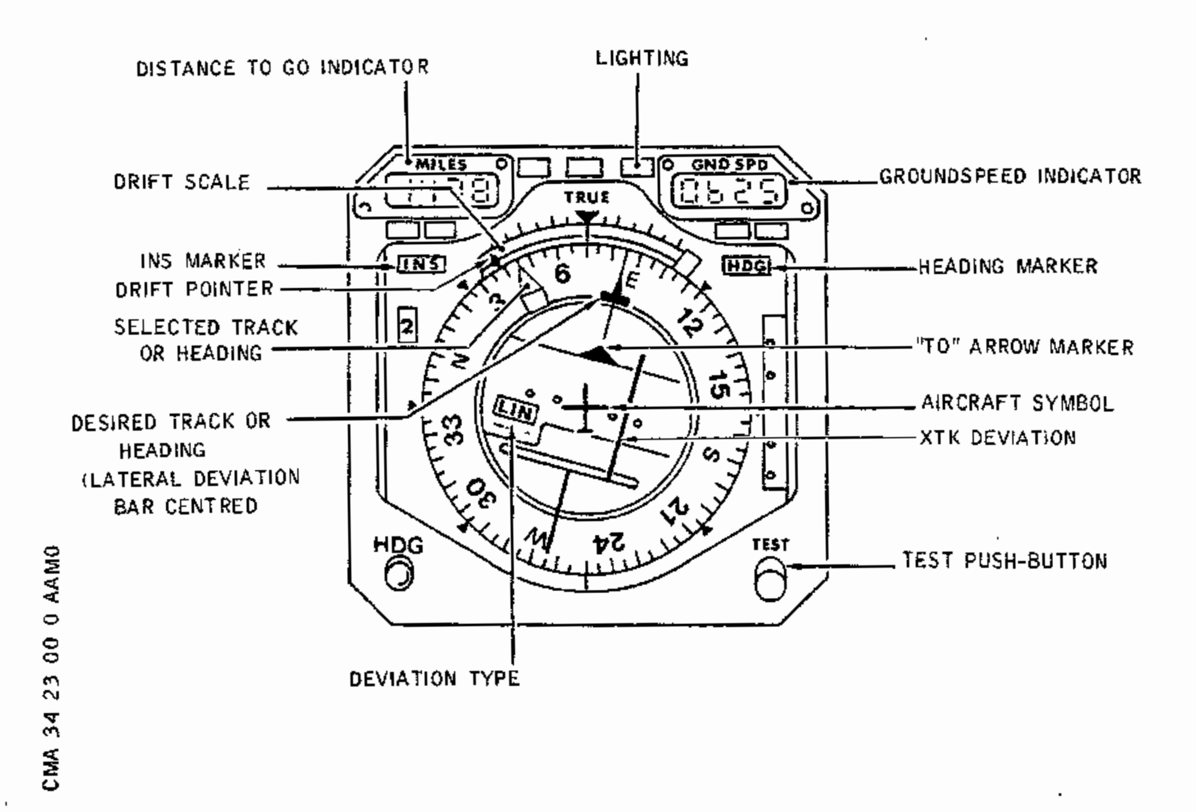
In order to continuously display certain flight parameters
R necessary to maintain the aircraft on selected axes the Captain and First Officer each have available a horizontal situation indicator (HSI) and an attitude director indicator (ADI). The HSI is used essentially for navigation. The ADI is an aid to piloting.
R Both systems also indicate the aircraft position with reference to an ILS beam.
Two track heading units produce an error signal which is sent
R to the autopilot and the HSI. For the two HSI this signal
R is the selected error angle (Selected heading less true or magnetic heading).

2. Horizontal Situation Indicator (HSI) (Ref. Fig. 001)

A. Description

Mounted on the Captain instrument panel (1F22) and the
R First Officer instrument panel (2F22), weight 3.5 kg (7.7 lbs), each indicator is in the form of a 5ATI case with dimensional characteristics according to ARINC 408 standards.
The indicator indicates aircraft heading and horizontal situation information determined with respect to a geographical reference or radio axes according to INS or RADIO mode.
The face has incorporated white illumination bulbs accessible from the front, intensity of illumination is adjus-
R table by RH DASH INSTRUMENTS and LH DASH INSTRUMENTS knobs
R located on the LH and RH side consoles. Behind the glass
R cover are a dial, a compass card, the aircraft symbol symbol and markers.
At the upper left of the face a drum marker gives INS and RAD indications, showing indicator mode of operation.
Below, a marker showing 1, 2 or 3 indicates the system supplying the information.
At the upper center of the face a marker indicates either TRUE or MAG to indicate the type of navigation.
Below this is the white fixed lubber line with reference to which heading readings are made. The lubber line is also the zero reference from which positive or negative drift angles are read.
At the upper right of the face a third marker indicates
R either TRK (track) or HDG (heading), showing the mode of operation of the track heading unit.





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R

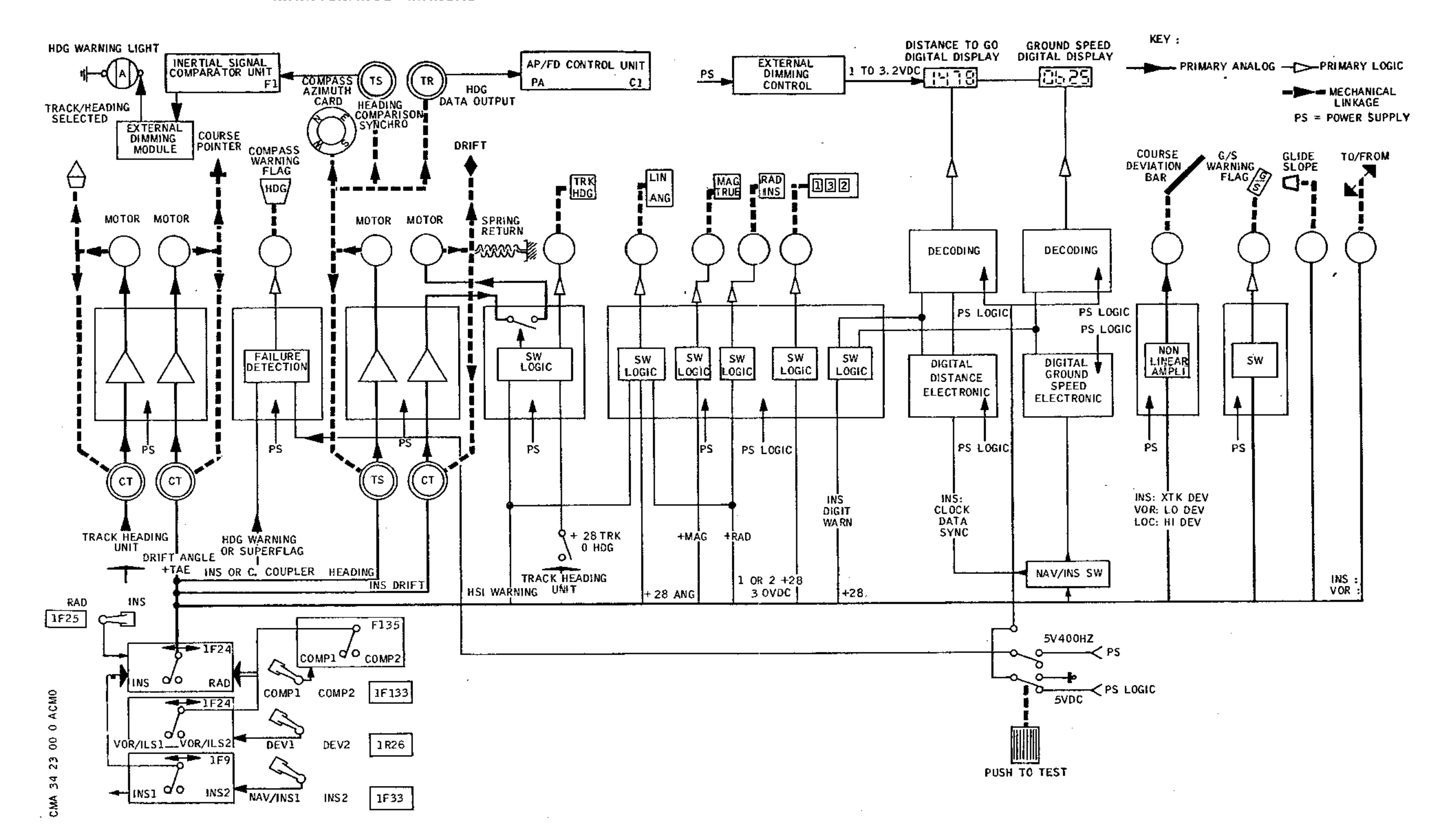
HSI - Front View
Figure 001

At the upper left of the indicator above the INS or RAD
marker, a digital indicator with a 4-digit luminous display
R marked MILES indicates in amber the distance TO GO.
At the upper right, above TRK or HDG marker, a second digi-
tal indicator marked GND SPD indicates groundspeed.
R At the lower left is the HDG warning light which illu-
minates in event of a difference in heading between the
R two HSI greater than a preselected value.
At the lower right is a TEST push-button.
At the right of the face a graduated scale and pointer is
used to indicate aircraft position with respect to a glide
beam.
R The markers, selected track or heading, course and drift
R pointers, lateral deviation bar, compass card and TO-FROM
R marker are controlled by the interfacing systems.
R At the centre of the compass card, the aircraft symbol re-
presents the plan view of an aircraft, nose towards the
top of the instrument. The zero reference point is the
intersection between the bars representing the fuselage
and the wings. The mask on which the symbol is mounted
is marked with a deviation scale, across which moves the
lateral deviation bar.
The indicator is mounted on the instrument panel so as to
permit reading at angles up to 30°.
The indicating elements and aircraft symbol are mounted so
as to avoid parallax errors. The black compass card is gra-
duated in 5° increments, it has a diameter of 88 mm. It has
white numerical markers every 30°, the four cardinal points
are marked by their initial letters N, E, S, W. The surround
is also black with white triangular markers at each 45°
point from the lubber line around the edge of the compass
card.
These triangle markers are used as reference points during
utilization of the various pointers. Heading reading is
made on the compass card with reference to the lubber line.
System interconnections are made by means of two rear con-
nectors.

The indicator consists of 4 servo-mechanism channels for
R presentation of heading, drift, selected track or heading,
R and desired course. Each channel consists of a synchro-
transolver, servo, monitoring and amplification printed
circuits, a DC servo motor for each indication.
The other indicators are operated by electro-magnetic and
logic circuit methods. The indicator has an internal power
R supply. Internal illumination of GND SPD and MILES indica-
R tor displays can be dimmed by means of an external dimming
R module.

B. Operation (Ref. Fig. 002)

INTENTIONALLY BLANK



Captain Horizontal Situation Indicator
(HSI) - Block Diagram
Figure 002

R

(1) Operation in INS mode

In INS mode the indicators receive information from the INS. Operation described is for the Captain HSI : Information switched by NAV/INS 1/2 selector unit (1F9) controlled by Captain NAV INS switch (1F33) enables selection of information to be supplied to the indicator either from INS1 or INS2. From the selector unit output the signals are sent to RAD/INS selector (1F24) controlled by INS/RAD switch (1F25). From the output the information is routed to the Captain HSI.

(a) Mode information

The selector (1F24) sends a zero volt logic signal to INS and TRUE markers which appear in the LH and centre windows. TRK/HDG mode change is controlled by TRK/HDG switch on AP/FD control unit. The marker is an electro-magnetic device.

(b) Information source

According to the position of Captain NAV INS1/INS2 switch, a + 28 VDC signal is applied to the marker in the LH window below INS window, the number of the INS which is supplying the indicator then appears in the LH window. The marker is a switch controlled, 3 position electro-magnetic device.

(c) Heading information

The compass card is controlled from the synchro-receiver by a monitored servo-mechanism, which includes a failure detection circuit. The true INS heading, after processing and amplification, is used to control a DC motor. Signal polarity determines the sense of motor rotation, which rotates the card to indicate INS heading against the lubber line. A + 28 VDC HEADING WARNING validity signal from the INS signifies correct heading operation.
A Heading Comparison synchro-transmitter and a Heading Data output sunchro-transolver are mechanically coupled to the compass card drive servo-mechanism and repeat heading information to the inertial signals comparator unit (ISCU), and the track heading unit via the AP/FD control unit.

(d) Track and drift information

Drift information is provided by a diamond shaped
Yellow pointer moving across a scale concentric
R with the compass card on the upper section. The
scale is graduated in 5° increments in a range
of 30° either side of the lubber line. Drift
angles to the right of the lubber line zero are
considered positive and to the left of zero are
negative angles.
Desired track is calculated by summing heading
indication and drift, the sign of the drift angle
being taken into consideration : Desired Track
= heading ± drift.
In the absence of drift the pointer is positioned
under the lubber line, and heading coincides with
track.

When drift information is unusable (failure),
the pointer is automatically retracted to the
right by a spring. Track information is no longer
available.
R A HSI WARNING + 28 VDC validity signal maintains
R the pointer in view ; removal of the + 28 VDC
causes retraction.
Drift information from the INS is received by the
control synchro (transolver), and after proces-
sing, is used to control the DC servo-motor
which drives the pointer (maximum error 20 minu-
tes). The drift servo-mechanism is not monitored.

R (e) Desired course information (True) (COURSE
POINTER).
R Desired course is indicated on the compass card
by a dagger shaped Yellow pointer. The pointer
moves over the card graduations. Reciprocal
course is indicated by a narrow pointer in oppo-
site sense to the first. These pointers are con-
R trolled by drift angle plus track error (DA +
R TAE) function of the INS. This information is
sent to the synchro-receiver (transolver) and
after processing, controls the pointer drive DC
servo-motor.

(f) Aircraft lateral position indication

Aircraft lateral position with reference to a
R desired true course is indicated by a galvanometer
R pointer (lateral deviation bar) coloured yellow,
moving across a deviation scale. The deviation
R bar support mask is mechanically coupled to the
R course pointer in such a way that the lateral
deviation bar is aligned in the same direction

as the pointer. The lateral deviation bar represents the relative position of the desired course with respect to the aircraft symbol.
Deviation value is read on the graduated scale marked on the mask. Deviation type is shown by the LIN marker indicating a linear value. INS deviation information is sent to a differential amplifier which drives the galvanometer.
Maximum error is 10 % of full scale deviation
Scale value is 37.5 NM per dot.
The LIN marker is a three position electro-magnetic device controlled by RAD/INS switch which switches a + 28 VDC level in INS mode.

(g) TO-FROM indication

A white arrow pointing in the same direction as the desired track supplies TO indication. It disappears and a second arrow appears in the opposite sense to indicate FROM. The galvanometer receiving the TO-FROM indication is mounted on the mask support of the deviation indicator device. Voltage information from the INS is switched via NAV/INS and RAD/INS switching units.

(h) Distance TO GO indication

This is the distance to go to the next waypoint on the INS track. Distance TO GO indication is provided by a 4 digit luminous indicator. It receives digital information from the computers via the NAV/INS switching unit. The digits are formed of 7 segments and the amber colour is obtained by insertion of a screen. The MILES sign above the indicator is illuminated by the 5V supply. The INS sends a validity signal to the indicator.
Disappearance of this signal causes the indicator illumination to extinguish.

(i) Groundspeed indication

Groundspeed indication is provided by a luminous 4 digit indicator.
It receives digital information via NAV/INS switching unit. The amber colour and illumination of the GND SPD sign are achieved in the same manner as on the distance TO GO indicator. Validity signal is also similar.
Distance and speed digital information is sent from the INS in 32 bit word format, (8 address,

8 reserve, 16 data bits). The signal is in BCD form and is transmitted on three pairs of wires which carry data, sych and clock signals. After processing the signals are input to the decoder which translates them into segment illumination.

(j) HDG warning light

The + 28 VDC amber heading warning light is controlled by the ISCU (Inertial Signals Comparator Unit) which compares instrument headings from the two HSI.
For an instrument heading difference greater than the comparator monitor threshold (3°51') the comparator sends the heading difference warning signal which illuminates the indicator HDG warning lights

(k) Dimming modules

The heading difference warning signal is transmitted to both HSI HDG warning lights by the ISCU via two dimming modules, the purpose of which is to reduce the intensity of illumination in the LO position.

(l) Selected track or heading display

Selected track or heading (TRK or HDG) are indicated on the compass card by a white triangular frame pointer.
This pointer repeats the information produced by the track heading unit according to mode of operation (TRK or HDG).

(2) RADIO mode operation

Mode change is carried out by the pilot by means of RAD/INS switch (1F25) which controls RAD/INS switching unit (1F24). The other section of this switching unit is controlled by DEV1/DEV2 switch (1R26) which enables switching of VOR ILS1/VOR ILS2 information. In the same manner COMP1/COMP2 switch (1F33) which controls switching unit (F135) enables switching of compass coupler 1 or 2 information to RAD/INS switching unit (1F24), which supplies the HSI. This switching unit is then in RAD position.

(a) Mode information

This is produced by RAD/INS switch (1F25) which

Printed in England

R sends a + 28 VDC signal to the MAG and RAD markers which appear in the indicator windows indicating that the information is RADIO type (VOR or ILS) and the reference heading is MAGNETIC (from the compass coupler unit).

(b) Origin of information

R Captain DEV1/DEV2 switch (1R26) determines VOR
R ILS1/VOR ILS2 selection by RAD/INS switching unit
R (1F24). The VHF/NAV control unit in service sends
R information to this switching unit (1F24). A
R + 28 VDC signal is sent via RAD/INS switching
R unit (1F24) to the control stage of the data
R source (1, 2, 3) marker on the HSI, which indi-
R cates the number of the VHF/NAV system supplying
R the HSI.
Indication 3 on the marker corresponds to the non-energized position of the electro-magnet.

(c) Heading information

R In RADIO mode, aircraft heading is of MAG magne-
R tic reference type from the compass-coupler.
A + 28 VDC validity signal is also supplied by the unit. Reading of heading is achieved in an identical manner as in INS mode.

(d) Reference VOR/LOCALIZER beam.

R VOR/LOC REF knob on the Captain or First Officer
R side of the AP/FD control unit (C1) enables se-
lection either of the VOR radial selected by the
R pilot or magnetic heading of the runway. The
R selected value read on the AP control unit digi-
tal counter is repeated by the dagger shaped poin-
R ter on the HSI.

(e) Aircraft lateral position indication

(e1) With reference to selected VOR radial

Lateral position of the aircraft is indicated by the lateral deviation bar on the indicator, read against the deviation scale. (The scale extremities correspond to a
R ± 2 V signal, 150 microamperes or ± 10°.
Deviation information is received by the galvanometer from the deviation stage of the VOR receiver.
The type of information is indicated by

the presence of the ANG marker, indicating angular deviation. This information is supplied by the VOR receiver in the form of a logic validity signal. The bar indicates
R deviation with respect to selected course indicated by the pointer.

(e2) With reference to the LOCALIZER beam of selected runway.

Aircraft lateral position with respect to the localizer beacon beam is indicated in the same manner as VOR lateral deviation. Deviation information supplied by the LOCALIZER section of the ILS receiver is sent to the differential amplifier then to the HSI galvanometer.
In case of a VOR or LOC deviation warning,
R the bar centres.

(f) TO-FROM indicator

(f1) In VOR mode, one of the TO or FROM arrows is visible.

(f2) In ILS mode, the TO-FROM arrows are not visible.

(g) Deviation indication with respect to GLIDE (ILS) beam.

At the right of the face is a graduated scale,
R with 5 scale markers, 2 at each side of a centre pointer. The GLIDE beam axis is indicated by a
R rectangular galvanometer indicator colored Yellow The pointer moves in a vertical sense, indicating
R beam deviation. (The outer marks on the scale
R correspond to a ± 150 microampere signal).
GLIDE deviation from the instrument stage of the receiver is applied to the galvanometer on the indicator.
In case of a GLIDE WARNING the pointer disappears

(3) Warnings

The fault warnings consist essentially of 3 fire-
R orange flags. In addition there is the HDG warning light, described in B. (1) (j).

(a) COMPASS flag

This is marked HDG. It is controlled by an electro-magnet and is normally retracted.
By return spring action it masks the lubber line, thus making heading reading impossible. Disappearance of the + 28 VDC validity signal causes appearance of the flag, which also appears in case of

- an INS or compass coupler failure, according to mode
- a compass card control servo-mechanism fault
- a defective synchro-detector winding
- loss of 26 V 400 Hz power supply
- internal power supply fault
- servo error from electrical or mechanical cause (the fault detector actuation threshold (2 to 6°) is laboratory adjustable).

(b) DEVIATION flag

DEVIATION flag is colored fire-orange with white dots resembling the lateral deviation scale. It is brought into view by return spring action in case of

- an INS HSI warning in INS mode
- a LOCALIZER receiver deviation fault in radio mode
- a VOR receiver deviation fault in radio mode.

(c) GLIDESLOPE flag

The fire orange glideslope flag, marked G/S, consists of a rectangular tag. It is controlled by an electro-magnet and is brought into view by return spring action in case of a GLIDE receiver fault.

(4) Test

When the test push-button is pressed it causes the switching of 2 microswitches, which, by cutting a 5 Volt signal to the decoder cause

- illumination of all the segments on the digital indicators which display all 8s.

By application of 5 V test voltage to heading servo-mechanism and to fault detection stage these microswitches cause

R - continuous rotation of compass card in an anti-clockwise sense.
R - appearance of HDG flag.

R Note that the other indicator functions are not tes-
R ted by means of the test push-button since they are monitored and controlled from information coming from
R the various interfacing systems.

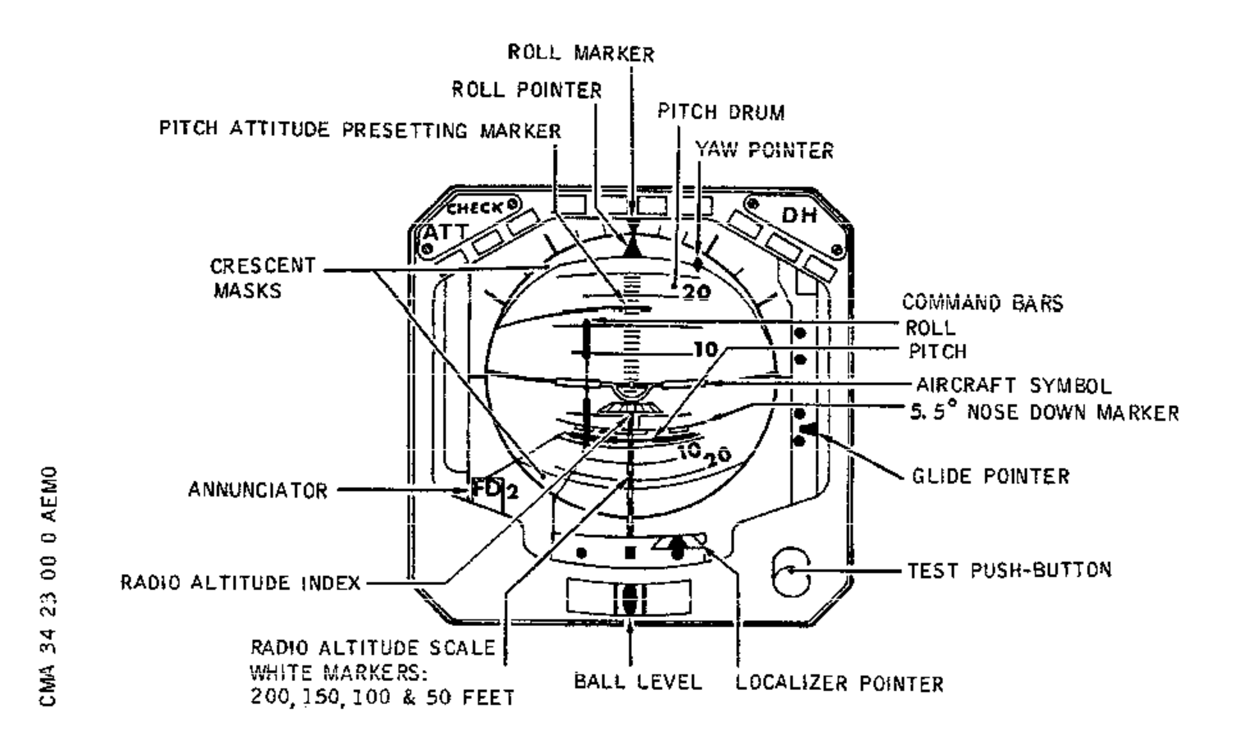
(5) Power supply

R The 26 VAC 400 Hz NAV/INS reference is sent through
R NAV INS1/INS2 and RAD/INS switching units and supplies
R the indicator in INS mode.
R Three transformers are supplied ; their secondaries
R produce regulated + 28 VDC, + 15 VDC and - 15 VDC for
R electromagnet control, 5 VAC 400 Hz for the test cir-
R cuit, regulated 5 VDC for logic circuits and regulated
R 3.2 VDC, adjustable by an external module, for the
R digital indicators.

3. Attitude Director Indicator (ADI)
(Ref. Fig. 003)

A. Description

The indicators are on the Captain instrument panel (1F23) and on the First Officer instrument panel (2F23), their
R weight is approximately 4.4 kg (9.7 lbs). Each indicator consists of a 5ATI case of which the dimensions are in accordance with ARINC 408 standards.
The indicator gives aircraft pitch and roll angle indica-
R tions, pitch, roll and decrab (yaw) command indications
R calculated by the flight director computers, angle of bank,
R the aircraft horizontal position with reference to ILS axes,
R approach radio altitude, pitch attitude to be maintained,
R remotely selected by an external knob.
R The face, which has built-in white illumination (10 lamps)
R directly accessible from the front, has an octagonal dial
R behind a glass cover, with a circular window, a graduated
R spherical altitude drum, an aircraft symbol on the horizon
R marker line, command bars, a decrab (yaw) pointer and a
R low altitude pointer. At the upper left of the indicator is
R the amber CHECK ATT warning light, at the upper right the
R amber DH (decision height) warning light. A TEST push-button
R is at the lower right.
At the lower centre is a ball bank indicator.
A glideslope indicator is located on the right side of the
R face with a centre line and 4 white dot markers.
On the lower part of the face is a localizer deviation
R scale with a centre white marker and two white deviation



ADI : Front View
R Figure 003

R dots. At the lower left is an annunciator with FD1 or 2
R markers which indicates the number of the computer which
R controls command indications. Interconnection with inter-
R facing systems is made by means of two connectors on the
R rear.

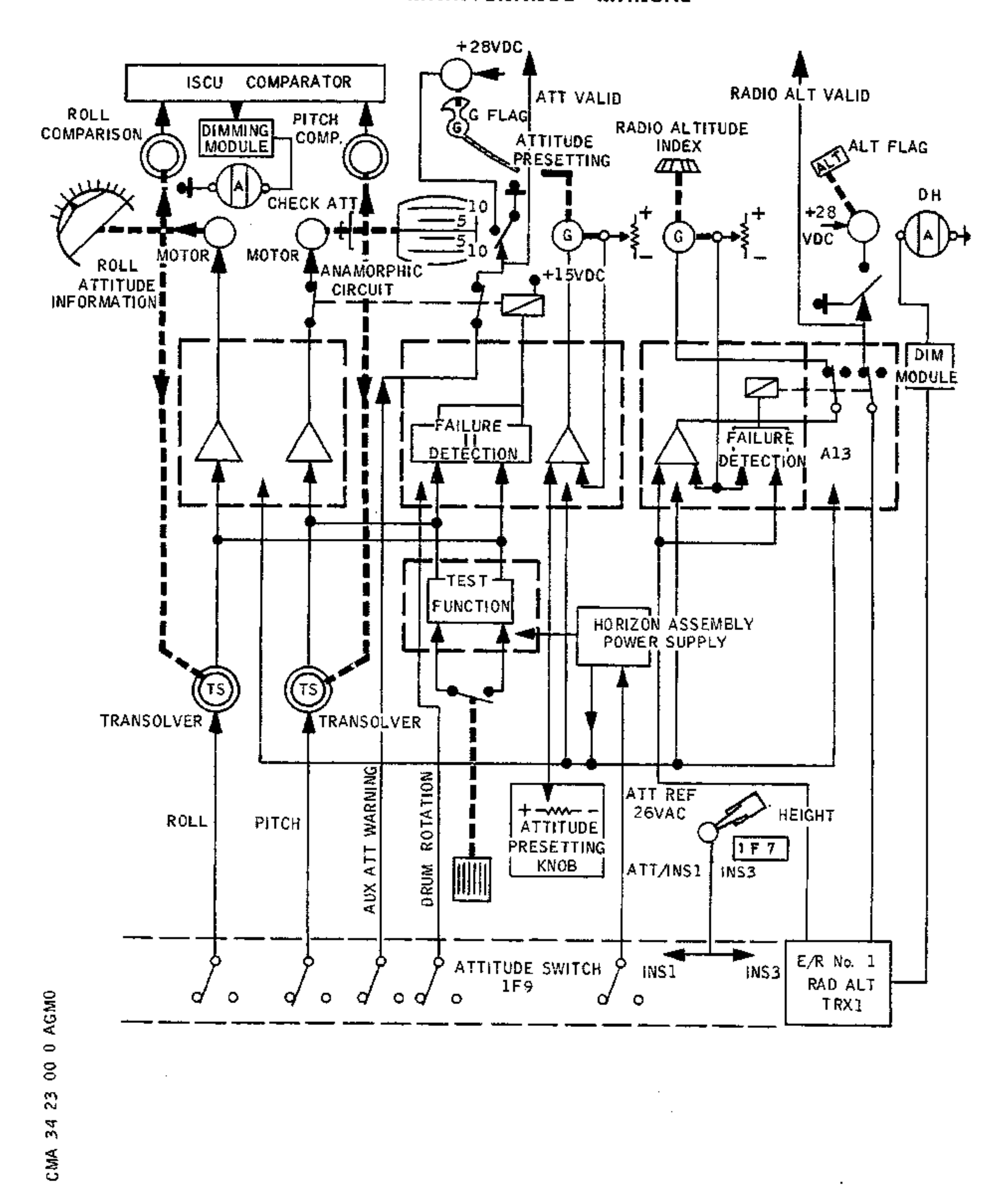
B. Operation

(1) Attitude indications (Ref. Fig. 004)

(a) Pitch

Attitude indications are supplied by means of a spherical drum which moves behind a fixed air-
R craft symbol in the centre of a circular window
R of 84 mm diameter. Rotation of the drum in
R nose-up sense is mechanically limited to 91°.
The section of the drum corresponding to nose-up attitude is graduated as follows :

- Short lines at each degree point up to 19°
- Long lines every five degrees up to 45°



Captain ADI - Altitude and Attitude Presetting Functions - Block Diagram
Figure 004

R

- Long lines every ten degrees up to 90°.

This section of the drum is colored blue, with black markers.
The section of the drum corresponding to nose-down attitude is dark grey, with white markers.
R Drum rotation in nose-down sense is limited to 91°. It is graduated as follows :

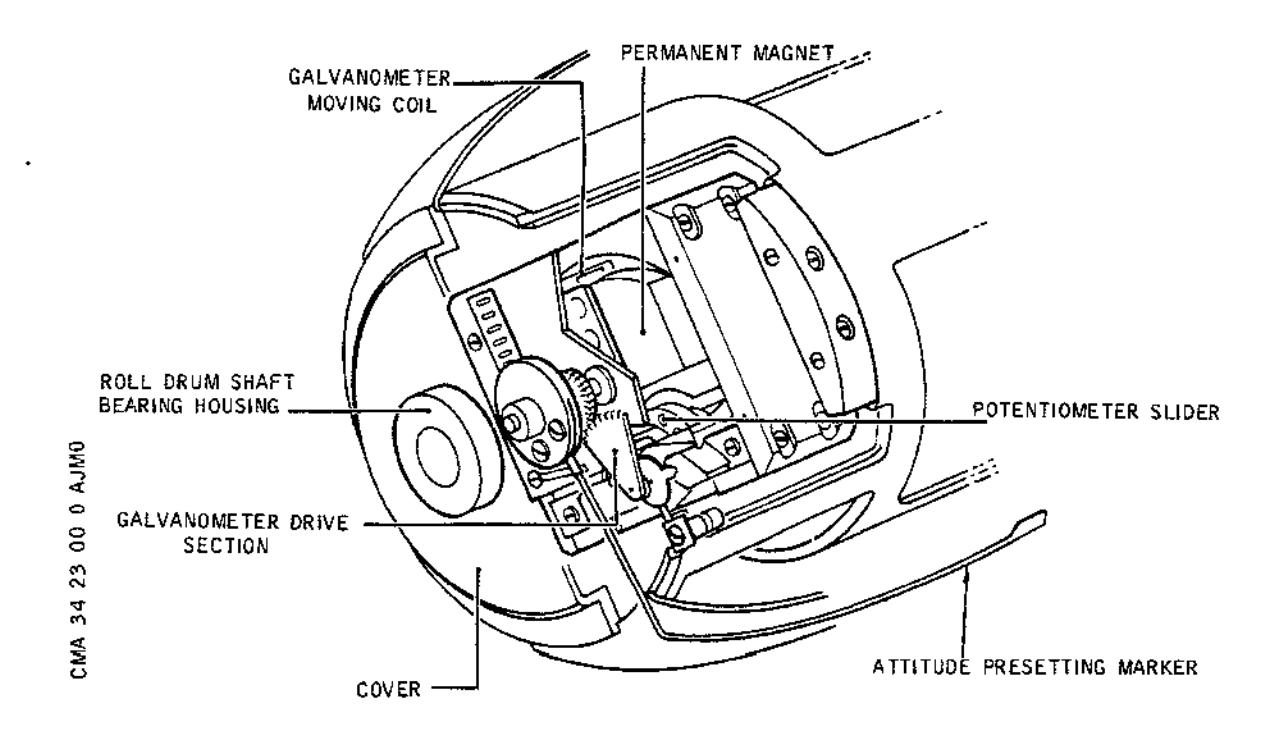
- Short lines at each degree point up to 9°
- Long lines every five degrees up to 45°
- Long lines every ten degrees up to 90°.

Drum diameter is 94 mm, maximum error 12' from
R - 10° to + 20°, increasing to 1° at 90°.
R Where the drum only displays one colour, a blue
R crescent on the upper part of the dial and a grey
R crescent at the lower part act as a constant reminder of the relative position of sky and earth. (According to drum rotation direction).
R The horizon line, the horizontal centre line of the drum, is represented by a white line.
The fixed aircraft symbol represents the aircraft.
R The symbol centre point corresponds to the air-
R craft centre line and acts as a reference point for pitch angle readings against the drum graduations. (At zero pitch angle the aircraft symbol appears 0.9 mm above the horizon line). The aircraft wings are represented by two horizontal
R bars.
In nose-down attitude, the horizon line rises with reference to the aircraft symbol which will be in the grey sector of the drum. In nose-up attitude the horizon line descends with reference to the aircraft symbol which will be in the blue
R sector. The centre point enables precise reading of nose-down or nose-up attitude on the drum.
A yellow and black bar acts as a 5.5° nose-down marker.

(b) Roll

Roll angle readings are made by means of the white pointer at the upper part of the blue roll mask (on the crescent) which moves with the drum around the circular roll scale. The scale consists of a zero roll angle marker with white markers at either side at 10, 20, 30, 45, 60 and 90° of roll. The freedom of the roll mechanism is unlimited in roll angle. Sensitivity is cons-
R tant at 0.74 mm/degree. Maximum error is 15'.

(c) Pitch attitude pre-setting (Ref. Fig. 005)



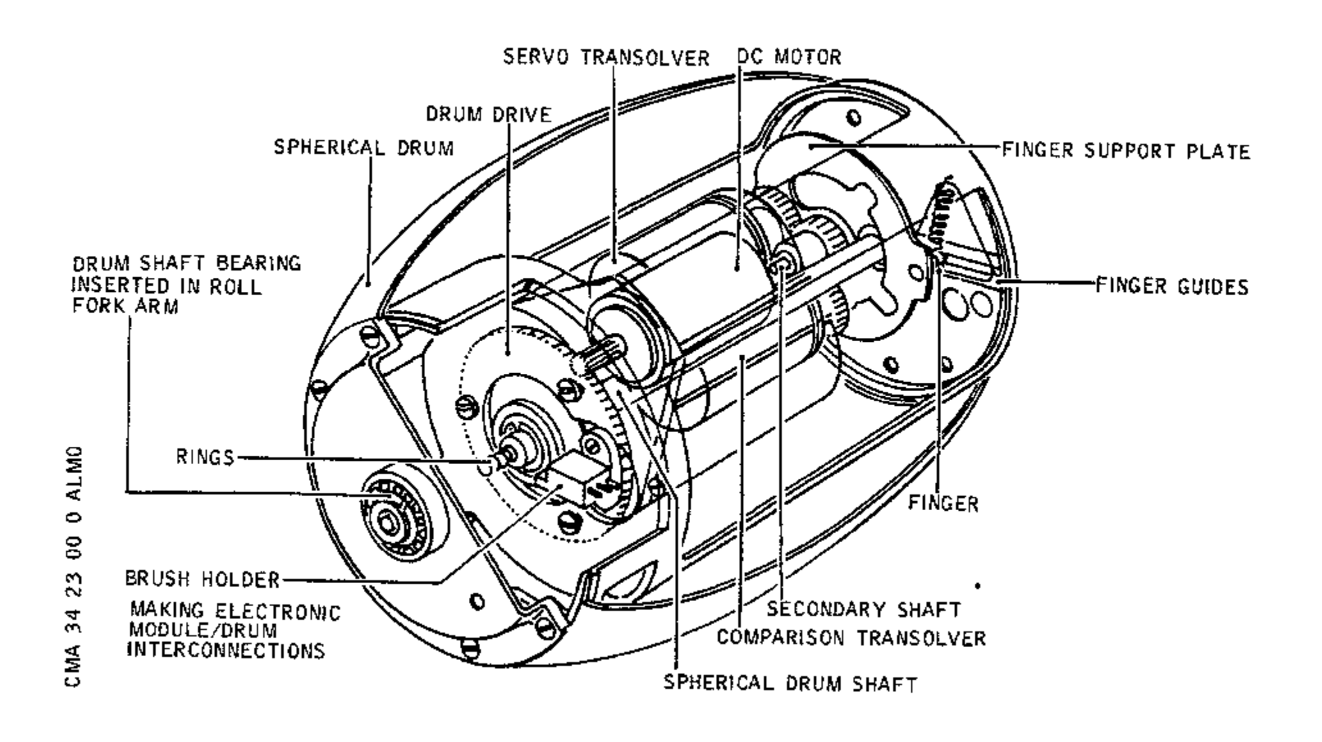
R Pitch Attitude Pre-Setting Mechanism
Figure 005

The pilots can select a desired angle (nose-up or nose-down) from 10° nose-down to 20° nose-up with an accuracy of 0.5° by means of the external pitch attitude presetting knobs on the Captain and First Officer control columns. The knob controls the potentiometer associated with the galvanometer, which is coupled by a gear train to the attitude presetting marker, a white bar which indicates the selected value on the pitch scale. The marker moves with the pitch drum.
To hold the selected attitude the marker must be maintained at the centre part of the aircraft symbol. According to the requirement of the pilot the pointer can be removed from view (It is out of view up to 56° nose-up attitude).

(d) Attitude information indicated by the ADI comes from the INS. For the Captain ADI it is switched through ATT/INS1 - INS3 switching unit (1F9)

controlled by ATT INS1/INS3 switch (1F7). The First Officer ADI receives INS2 or INS3 information through ATT/INS2 - INS3 switching unit (2F9) controlled by First Officer ATT INS2/INS3 switch (2F7).

(e) Pitch mechanism (Ref. Fig. 006)

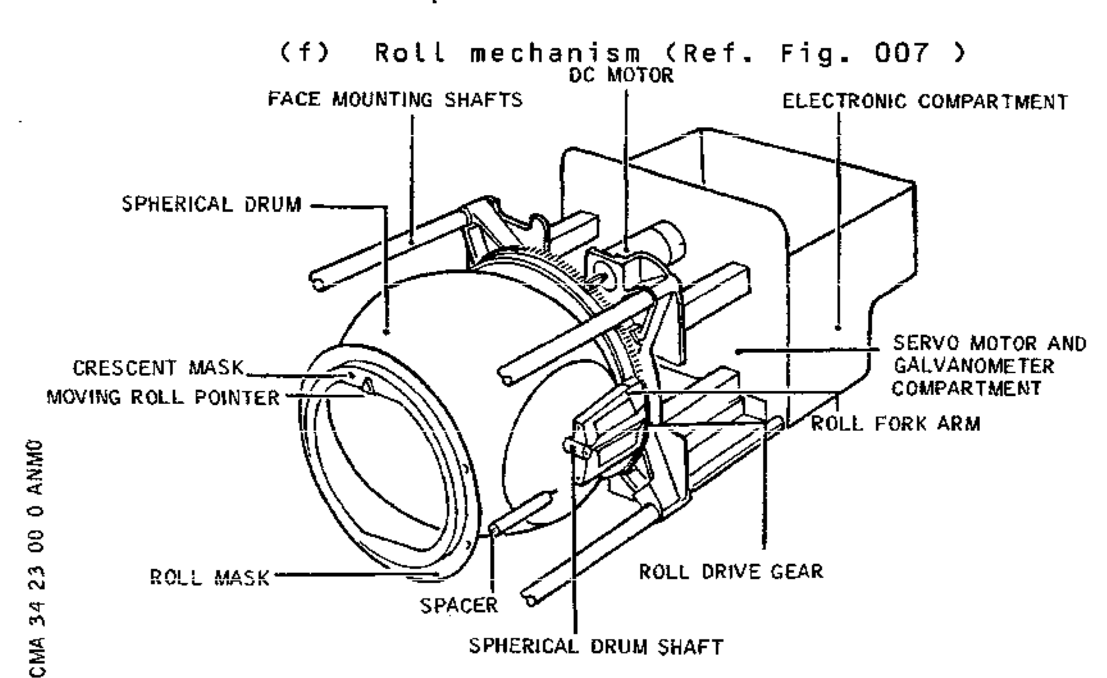


R Pitch Mechanism
Figure 006

Attitude information from the INS synchro-transmitters (ROLL2-PITCH2) is applied to the pitch and roll servo-channels. After processing the pitch signal controls the DC motor, the motor gear directly drives a gear which is coupled to the spherical attitude drum.
The rotary elements : DC motor, comparison synchro-transolver, and the control synchro-transolver which repeats drum position according to INS pitch signal are coupled to a support.
The synchros are coupled by a gear train which follows drum rotation according to a law imposed by its anamorphic mounting. This consists of a

disc coupled to a gear driving a secondary shaft mounted in two bearings.
This shaft, coupled to the rotary element support, is eccentric to the drum shaft. The disc has a finger moving in a slot solidly coupled to the
R drum, made up of two small bars. A spring continuously holds the finger in contact with a bar irrespective of the direction of drum rotation.
When the DC motor drives the drum, the eccentricity of the shafts enables the finger mounted on the disc to slide in the slot. This results in a change in the lever arm finger/drum drive which modifies the disc drive/spherical drum ratio. A stop on the drum support with a second matching stop on the roll drive mechanism limits drum displacement to 193°.

(f) Roll mechanism (Ref. Fig. 007)



Roll Mechanism
Figure 007

The circular roll mask supported by 4 mounting shafts is located at the rear of a platform sup-

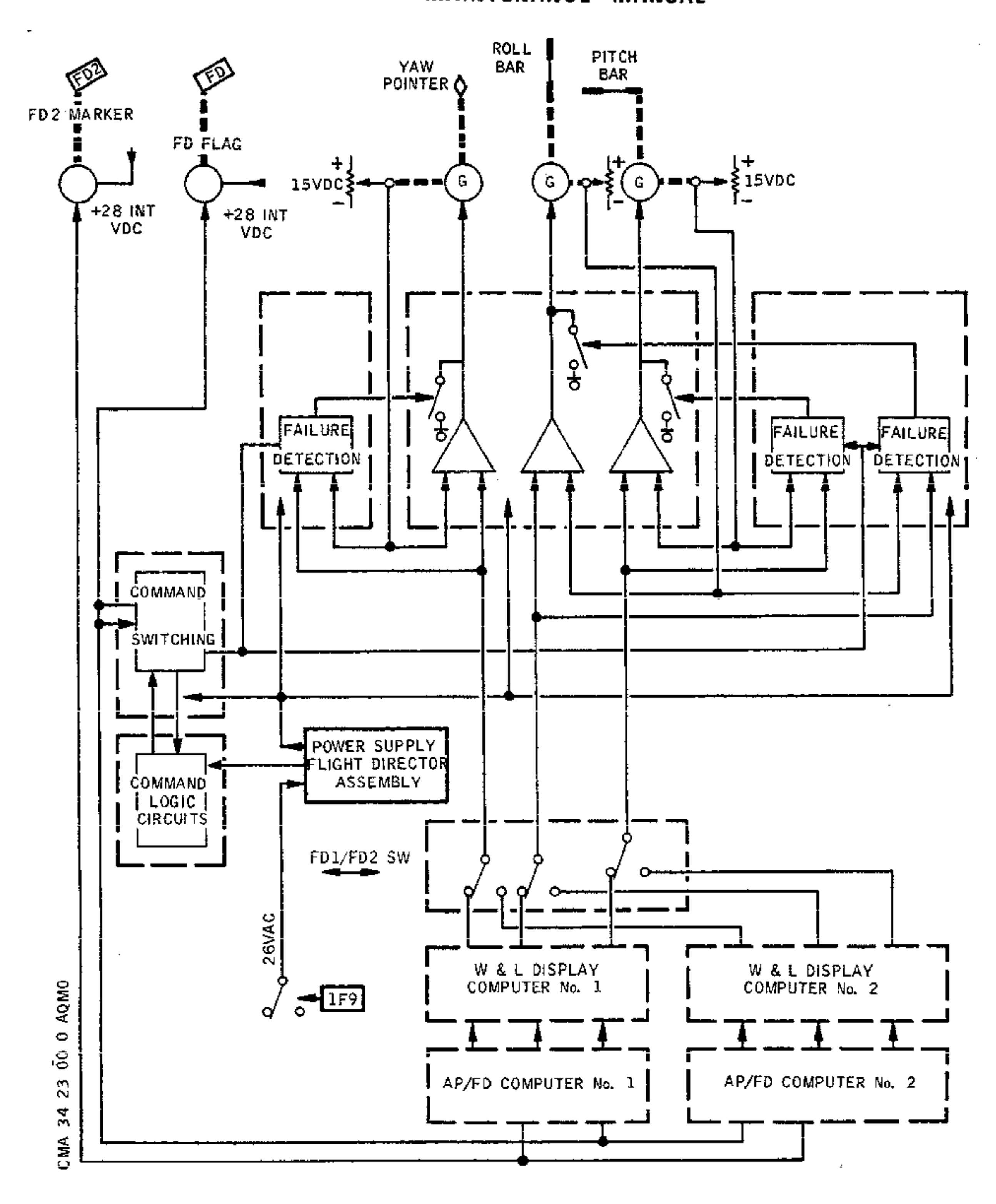
porting the motor, roll and servo control synchros, the electronic modules, and the indicator. At the forward part four supports hold the roll disc with its two roll fork arms and drive gear. In front of the disc, two spacers provide a mounting for the roll mask carrying the crescents and moving roll pointer. The arms of the roll fork enable insertion in a housing of the pitch support shaft bearings which are driven by the roll mechanism. Connections with the servo-mechanism channels are made by connectors. The chassis is also fitted with a time of operation counter.

(2) Command indications (Ref. Fig. 008)

Command indications calculated by the pitch and azimuth AP/FD computers are indicated by

- a vertical saturn yellow bar for roll (AP/FD azimuth)
- a horizontal saturn yellow bar for pitch (AP/FD pitch).
- a diamond shaped pointer for yaw or decrab (AP/FD azimuth).

A marker flag controlled by an electro-magnet from FD1/FD2 switches on the Captain and First Officer instrument panels indicates in yellow markings on a black ground the flight director computer which controls the indicator (FD1 or FD2). Command indications are controlled by galvanometers, which are directional with an accuracy of 10 % of theoretical displacement.
The 3 galvanometer channels are identical and consist of 1 galvanometer, 2 operational amplifiers, 1 power amplifier and a fault detector circuit.
After processing, the flight director signal determines an error signal with reference to the potentiometer slider signal from the galvanometer. This signal is returned to the galvanometer control amplifier input, to which the signal is also sent directly from the computer. According to polarity, this error signal displaces the galvanometer needle, either by mechanical or electromagnetic means. The command bar under consideration will be at zero when it coincides with the centre of the aircraft symbol (the centre section of the bar is narrow to facilitate reading). The command is indicated by the amplitude of lateral displacement : 16 ± 1.6 mm at either side of the aircraft symbol centre. Displacement of the decrab (yaw) pointer with respect to zero point on the roll scale is 26 ±



Captain ADI. Command Operation - Block Diagram
Figure 008

R

2.6 mm. The galvanometers are mounted on the platform behind the roll chassis. There are a total of 6 identical galvanometers (3 command, radio altitude, glide and localizer). Their connections are made by means of two miniature connectors.

(3) Altitude indication

Altitude indication is supplied between 240 ft and the ground by a trapezoidal index in striped arc-yellow. The narrow side is at the upper part and suggests a perspective view of the runway. The index moves vertically across a graduated scale. The white scale markers correspond to 200, 150, 100 and 50 ft ; the 0 marker is arc-yellow.
The index is controlled by a galvanometer, which is activated by a signal from the radio altimeter.
The index is not normally visible, and appears at 240 ft. altitude, rising as altitude decreases until the narrow side of the trapezoid is tangential to the lower semicircle of the aircraft symbol at zero altitude. The index control circuit is automatically monitored, and in case of a fault the index disappears by return spring action.
Maximum error is 1 ft. between 0 and 100 ft., above 100 ft. it is 1 % of indicated value. The radio altimeter supplies a + 28 VDC validity signal.

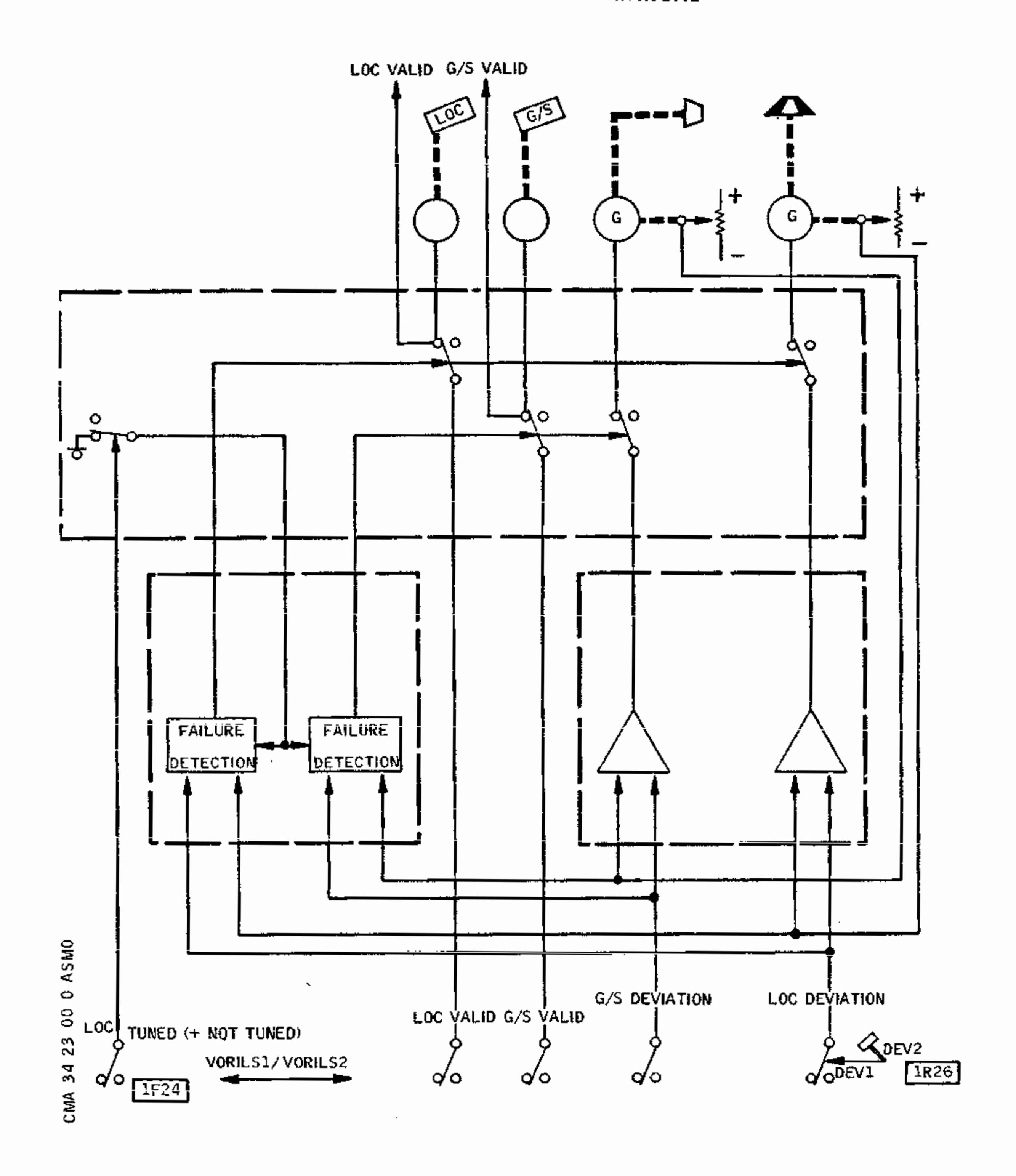
(4) ILS indications (Ref. Fig. 009)

(a) Localizer :

High sensitivity localizer deviation is indicated by a trapezoidal pointer, coloured black with white edges, the narrow side towards the top, representing the runway. The pointer moves laterally to left and right of a centre marker. Two white dots at the ends of the scale indicate deviation, 14 ± 4 mm to either side of the central marker. The localizer pointer is driven by a galvanometer which is controlled by the ILS/ LOCALIZER receiver which in addition supplies a validity signal. If a fault signal is received or if LOCALIZER is not in use, the pointer is retracted.
It is also retracted in case of a servomechanism fault.

(b) Glideslope :

Glideslope deviation is indicated by a triangular



Captain ADI Indicator, ILS Operation
Block Diagram
Figure 009

pale yellow pointer, moving along a graduated vertical scale.
A white marker represents the glideslope axis. Two white dots at either side of the marker indicate aircraft position in the glide beam. The pointer is driven by a galvanometer which is controlled by the ILS/GLIDESLOPE receiver, which also supplies a validity signal.
Pointer movement is ± 16 ± 1.6 mm to either side of the centre marker. ILS signals are automatically monitored.
On appearance of a LOC NOT TUNED signal from the ILS, the LOCALIZER and GLIDE pointers are retracted.
Simultaneously, this signal causes LOC and GLIDE flags to disappear.

(5) Ball level

Positioned at the lower centre of the indicator, the level consists of a curved transparent tube containing a black ball floating in a damping liquid. The ball moves to either side of zero, indicated by two black bars. Ball displacement is approximately 2.25 mm per degree. Zero adjustment is made from the front of the instrument. Illumination of the level is by means of an opening in the mask.

(6) Warnings (Ref. Fig. 010)

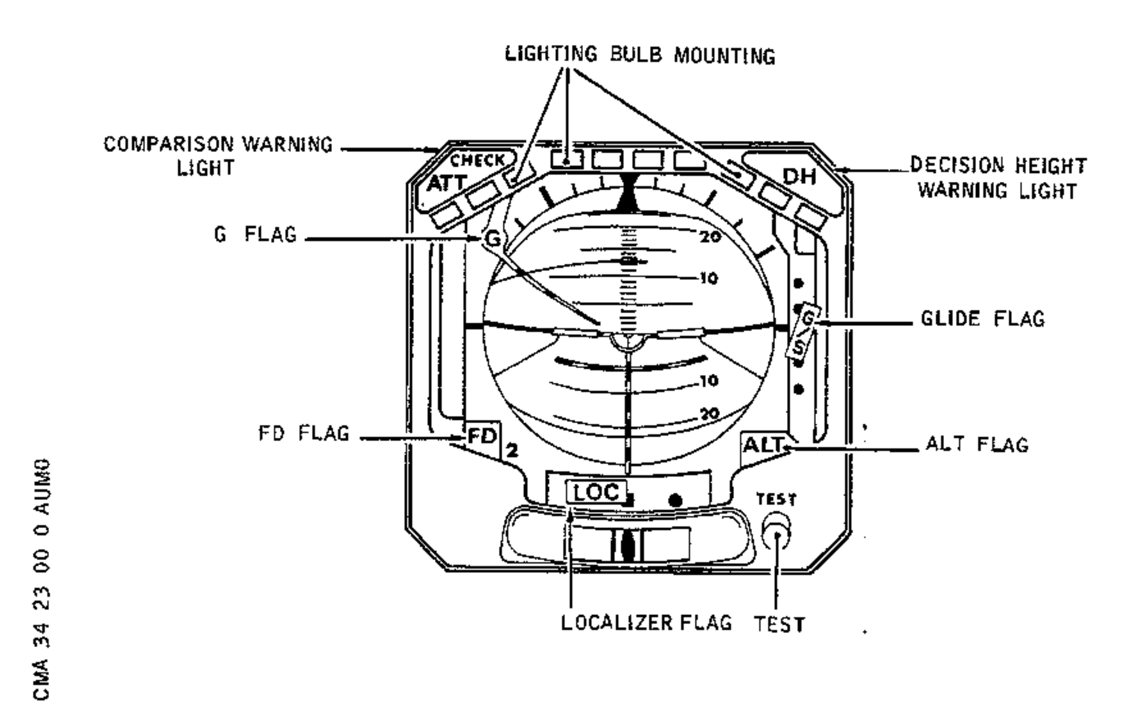
(a) G gyro flag

This flag is concerned with attitude indications.

The black striped orange gyro flag appears diagonally in the upper left quarter of the dial when visible. It is electro-magnetically controlled, the electro-magnet being energized by an automatically monitored fault detection circuit. The flag is normally held retracted by the INS validity signal.
The fault detection circuit causes the flag to appear for the following faults

- loss of 26 V 400 Hz indicator power
- internal power supply fault
- servo error from electrical or mechanical cause
- open synchro detector winding
- loss of INS transmitter excitation.

The flag also appears for a loss of INS validity



ADI : Front Panel (Flags Visible)
Figure 010

R signal and when the test button is pressed.
Time constant is 0.2 to 1 second.
R The fault detection threshold is 3 ± 1°, laboratory adjusted.
R The indicator supplies a + 28 VDC validity signal
R (correct operation). Presence of the flag indica-
R tes to the pilot that attitude information is no longer valid. However information supplied by the pointers can still be used.

R (b) FD flight director flag - retraction of command bars

R This flag is concerned with command indications
R (pitch, roll and decrab or yaw). It is controlled by an electro-magnet energized by an automatically monitored control circuit. For a fault in operation of the flight director or fault detected by the internal monitor, the flag appears at the lower left of the dial and will partially mask the FD1 or FD2 annunciator marker, leaving visible only the number of the computer which supplies

R command indications to the indicator.

(b1) In normal operation, when power is switched on, the flag is retracted, indicating correct operation of the computer.
Its appearance on loss of the validity signal is carried out by means of logic which also produces a second signal for the galvanometer control channels. According to the time constant sent to the logic circuit, which causes the galvanometers to be shut
R off, the command bars will also be retracted in case of a fault unique to the flight director.

(b2) The monitor stage includes a threshold and time constant detector. If the control signal exceeds the preset threshold the detector activates the logic which authorises shut off of the galvanometer which controls the
R command bar under consideration. This is then retracted.

R (b3) For loss of computer input signal (pitch or roll).
The galvanometer control amplifier no longer has an input.
Also there is no input signal at the monitor stage comparator, this causes shut off of the
R galvanometer which controls the command bar under consideration, which is then retracted.
R Thus the flag appears for

R - loss of FD computer validity signal
R - fault detected by the internal monitor
R - loss of 26 VAC 400 Hz indicator power
R - internal power supply failure
R - servo error from mechanical or electrical cause
R - disconnection between the FD computer and
R the indicator.

R The indicator repeats a validity signal from the flight director (+ 28 VDC).
The fault detection threshold is 80 ± 20 mV, adjustable.
The activation voltage is constant regardless of computer signal value. The time constant is from 0.2 to 1 second.

R (b4) Intentional clearing of a command bar

Clearing of a bar or of the pointer can be caused by superimposition of a signal on the control signal from the flight director. Processing of the signal by the monitor channel concerned brings about shut off of the galvanometer and thus the required clearing.

(c) ALT altitude flag

This flag is concerned with altitude indications. It is in the form of a fire orange tab marked ALT and appears at the lower right of the dial, masking the altitude index.
Internal monitoring similar to that of the command bar stages cause the flag to appear for

- loss of 26 VAC 400 Hz power supply
- internal power supply fault
- servo error from mechanical or electrical cause.

The indicator repeats a validity signal from the radio altimeter indicator.
Fault detection threshold : 300 ± 50 mV, adjustable.
Activation voltage constant regardless of signal value.
Time constant : 0.2 to 1 second.

(d) ILS flags

(d1) LOCALIZER flag - pointer retraction

The fire orange rectangular LOCALIZER flag marked LOC appears on the localizer scale. It is controlled by an electromagnet and retracted when the instrument is energized. Operation of the control and monitoring circuits is identical with those of the command bar stages. The pointer retracts when the flag appears in case of a fault.

The internal monitor detects the following faults :

- loss of indicator 26 VAC 400 Hz power
- internal power supply fault
- servo error of mechanical or electrical origin
- LOCALIZER receiver fault for the following conditions :

TUNED	+ 28VDC LOC NOT TUNED	0 V LOC TUNED	
LOC VALID	0 OR + 28 VDC	+ 28 VDC LOC VALID	0 V LOC NOT VALID
INDICATION	POINTER AND FLAG RETRACTED	POINTER IN VIEW FLAG RETRAC-TED	POINTER RETRACTED FLAG IN VIEW

Fault detection threshold is 80 ± 20 mV adjustable in laboratory. Time constant is 0.2 to 1 second. Activation voltage is constant regardless of signal value.
The indicator repeats a + 28 VDC LOCALIZER indication validity signal.

(d2) GLIDE flag - pointer retraction

The fire orange rectangular GLIDE flag marked G/S appears diagonally on the glide scale. It is controlled by an electro-magnet and retracted when the instrument is energized. Operation of the control and monitoring circuits is identical with those of the command bar circuits. The pointer is retracted when the flag appears in case of a fault.

The internal monitor detects the following faults

- loss of indicator 26 VAC 400 Hz power
- internal power supply fault
- servo error of mechanical or electrical origin
- GLIDESLOPE receiver fault for the following conditions :

TUNED	+ 28VDC LOC NOT TUNED	0 V LOC TUNED	
GLIDE VALID	0 or 28 VDC	+ 28 VDC GLIDE VALID	0 V GLIDE NOT VALID

TUNED	+ 28VDC LOC NOT TUNED	0 V LOC TUNED	
INDICATION	POINTER AND FLAG RETRACTED	POINTER IN VIEW FLAG RETRAC-TED	POINTER RETRACTED FLAG IN VIEW

The indicator repeats a + 28 VDC GLIDE indication validity signal.
Fault detection threshold is 300 ± 40 mV, laboratory adjustable.
Activation voltage is constant, regardless of signal value.
Time constant is 0.2 to 1 second.

(e) Warning lights

(e1) Amber CHECK ATT warning light at the upper left of the indicator illuminates in case of a difference in attitude indications between the two indicators greater than 3°51'. The 28 VDC warning signal is sent by the inertial signals comparator unit (ISCU) via two dimming modules to the two ADI.

(e2) DH decision height warning light at the upper right of the indicator illuminates below the height selected when decision height is set on the altitude indicator. The OV (ground) warning signal is sent to the DH warning light on the two ADI via two dimming modules.

(f) Tilting of ADI attitude drum

The ISCU, which controls illumination of CHECK ATT warning lights on the Captain and First Officer ADI, produces a second logic signal (OV or + 28 V). The 28 VDC causes the ADI attitude drum to move 90° in the nose down sense and G flag to appear on the relevant indicator in the following three conditions

- attitude deviation greater than 3°51'

- INS fault warning sent to the ADI
R - correct operation of INS3.

When an ADI is switched to INS3, the drum movement command cannot be sent.

(g) Test

The attitude servo-mechanisms are tested by
R pressing TEST push-button, at the lower right
of the indicator face.
R Test push-button operation initiates

R - appearance of G flag
R - displacement of the roll mechanism to the right
R - upward displacement of the pitch drum
R (movement of approximately 15° in both cases).

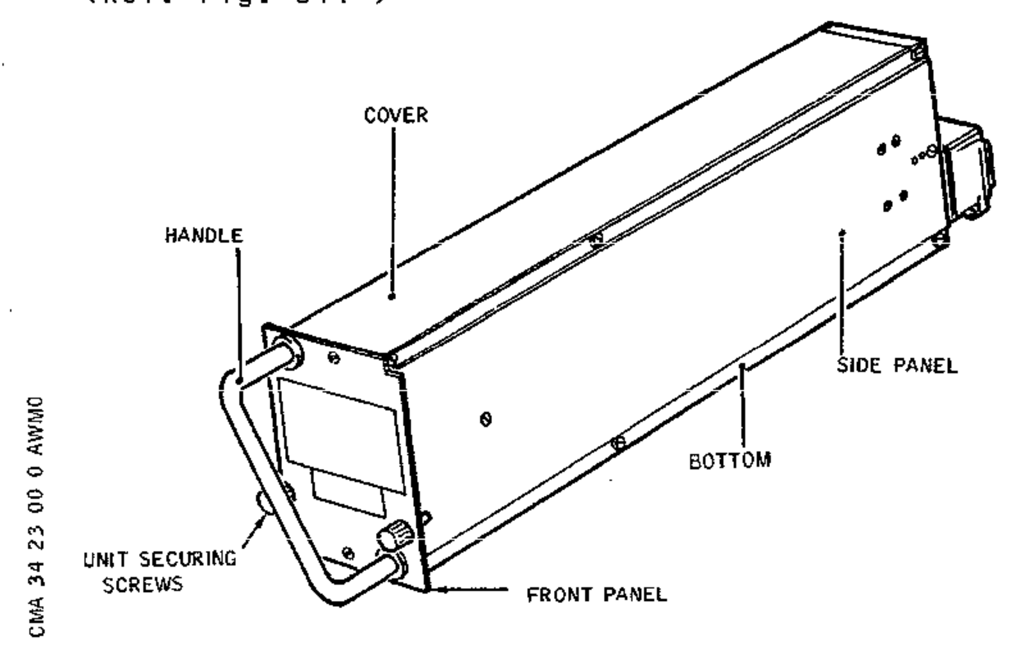
When test push-button is pressed a microswitch is closed which activates the test relay to energize the test circuit.
The test signal is superimposed on the roll and pitch transolver control signals, and acts as an error signal produced by a dephasing circuit which causes a phase shift of approximately 15°. After transolver positioning, the residual error detected by the monitor circuit causes appearance of
R G flag.

(h) Power supply

The horizon section of the indicator is supplied
by a transformer with a primary voltage of 26 VAC
400 Hz, and three secondary windings of which two
R are identical, supplying regulated ± 15 Volts.
The windings are connected to horizon assembly
ground, isolated from 26 VAC and instrument
ground. The third secondary winding is used to
supply the pulse generator in the attitude and
R test assembly. It also supplies + 28 V for the G
R and ALT flag electro-magnets.
The flight director function is supplied from a
R second transformer in the unit, the primary of
R which is supplied with 26 VAC 400 Hz voltage,
R with three secondary windings. Two of these
secondary windings supply ± 15 VDC for the flight
director stages of the indicator. The third output
supplies a regulated 5 VDC for the logic circuits.
The secondary windings are isolated from 26 VAC
and instrument ground and the centre taps provide
a FD assembly ground reference. A relaxation

oscillator supplied by 15 VDC sends a signal which
is used to produce the flight director fault
R signal (command bar clearing). The power supply
R also provides + 28 VDC for FD markers and FD,
R G/S and LOC flags.

4. Track Heading Unit
(Ref. Fig. 011)



Track Heading Unit
Figure 011

A. Description

The track heading unit is a double ELFIN module conforming
R to ARINC 404 standards. Weight is 1.9 kg (4.18 lbs).
The case has a grey rectangular front panel with a diago-
nally mounted carrying handle, cover attachment screws and
rack securing screws. The case is enclosed by two side
R panels and an upper and lower panel secured by screws. The
rear panel has a connector for interconnection with air-
craft systems. The interior consists of two sections. The
front section contains the servo systems, the two DC motors,
2 transolvers and 2 synchro-transmitters. The unit is fit-

ted with an hour counter. The rear compartment contains the
electronic modules, servo amplifier, fault detection and
power supply.
Range of operation of the unit is 30°. The mechanical
stops are set to 31°. Maximum repeat error is ± 15 minutes,
servo threshold maximum 10 minutes.
R Fault detection sensitivity is 2° to 6°, adjustable.
R Time constant is 1 to 2 seconds, adjustable.

B. Operation (Ref. Fig. 012)

R Each track heading unit produces, by means of electro-
mechanical devices, commands intended for the automatic
pilot and the associated HSI. For this purpose it receives
R information

R - of deviation from selected track or heading : selected
R track or heading minus magnetic or true heading, and of
R TRACK or HEADING mode, from each AP control unit

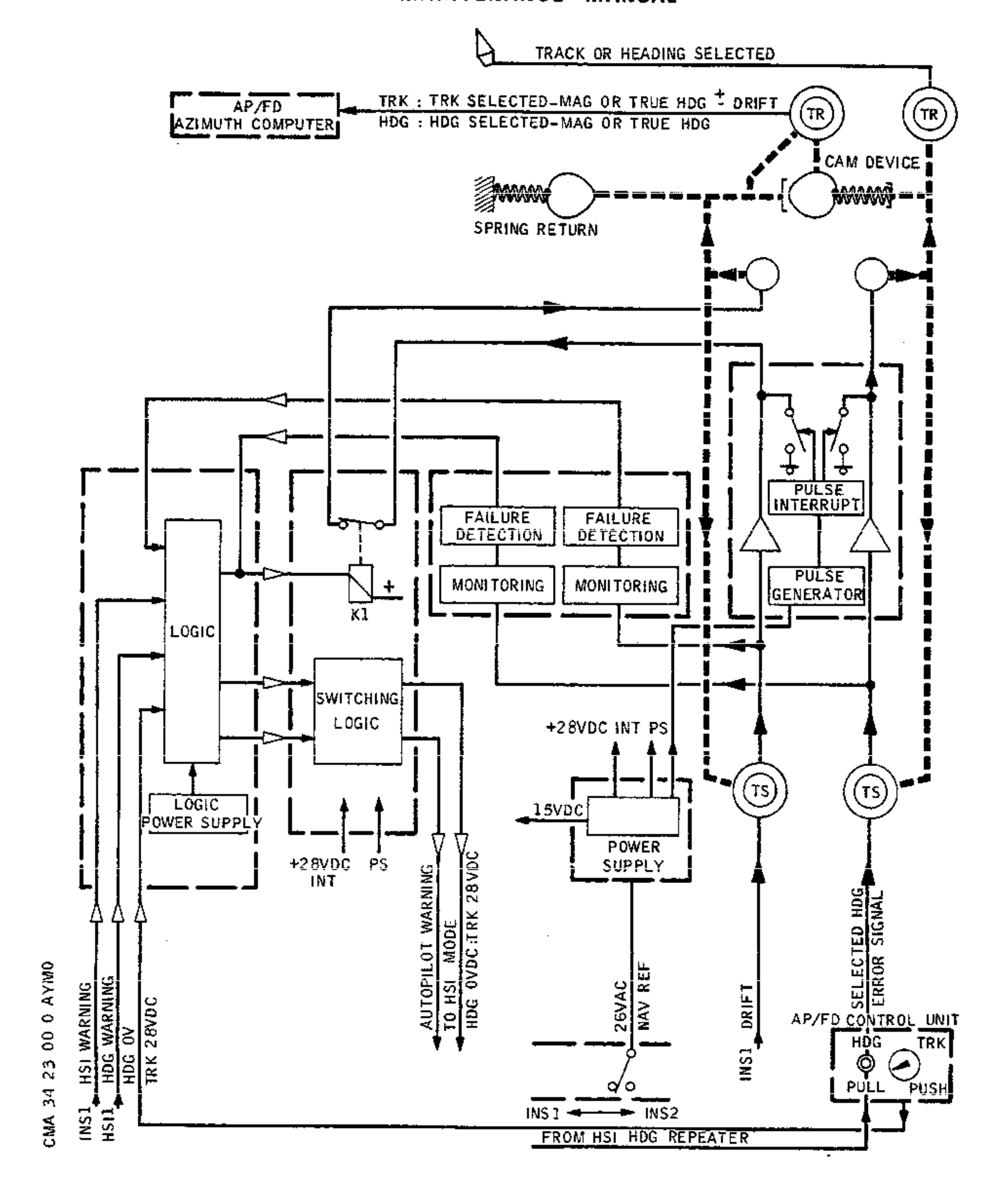
R - of drift, from INS1 or INS2.

R The following information is produced after processing

R - In TRACK mode, selected track deviation : selected trade
R minus magnetic or true heading plus drift.
- In HEADING mode, selected heading deviation : selected
R heading minus magnetic or true heading.
Whichever mode is selected, the HSI receives and indica-
tes this deviation.
The track heading unit includes an internal monitor unit
and receives from the INS and HSI respectively a validity
signal. It sends a warning signal to the AP and a signal
repeating the mode of operation to the HSI.

(1) Drift channel operation

Drift information from the INS is received by the
drift transolver in the unit. The signal is routed to
the servo-amplifier and to the fault detection circuit
which also receives the signal from the other trans-
olver winding and the INS validity signal. Drift in=
R formation after amplification controls the DC motor
in TRACK mode. The polarity of the control signal de-
termines the direction of rotation of the permanent
magnet motor, which tends to return the input trans-
olver rotor to its null point. The motor then stops
until arrival of further drift information. The motor
also drives the output synchro transolver stator and
this information is sent to the automatic pilot. A
system of stops limits displacement to ± 30°. A return



Track Heading Unit - Pilot Information
Figure 012

R

spring returns the mechanisms to zero. The DC motor is only energized in TRACK mode via a contact of relay K1 and the unit logic circuitry, with + 28 VDC from the AP/FD control unit TRACK switching unit. This relay is de-energized by the fault detection circuit after a time delay, cutting off drift motor power.

(2) Selected heading deviation channel operation

Selected heading deviation information from the AP/FD control unit is received by an input transolver. Channel operation is identical with that of the drift channel. The output synchro-transmitter rotor supplies selected track or heading deviation to the HSI.

- In TRACK mode : selected track minus magnetic or true heading plus drift.
- In HDG mode : selected heading minus magnetic or true heading. The rotor is driven by the deviation channel and receives 26 VAC. The stator is driven by the drift channel.

A special cam device enables track or heading change operation greater than 180° without cancellation of transmitted signal.

(3) Monitoring

The unit includes a monitoring and fault detection circuit which produce warning and monitoring signals. The + 28 VDC validity signal routed to the AP disappears in the following conditions

- loss of synchro-transmitter excitation
- loss of unit power supply
- internal power supply fault
- servo error of electrical or mechanical origin in the selected heading channel
- loss of HSI validity signal.

TRACK mode of operation sends a + 28 VDC validity signal to the HSI, which disappears in the following conditions

- loss of synchro-transmitter excitation
- loss of unit power supply
- internal power supply fault
- servo error of electrical or mechanical origin in the drift channel
- loss of drift validity signal
- intentional transfer to HDG mode.

The channel fault detection circuits include time delays to enable setting of new data without activation of warnings. In case of a loss of input synchro signal, the monitoring circuit causes disappearance of the validity signals at a preset threshold. The pulse generator indicates a power supply failure by inhibition of the drift and selected heading deviation amplifier outputs.

(4) Power supply

R The unit is equipped with a 26 V 400 Hz transformer.
R Three secondary windings, of which two are identical,
R supply regulated 15 Volt power supplies. From these two supplies the + 28 VDC is taken for the validity outputs, and the 5 VDC for the logic control stage. The third secondary winding output is used to supply the pulse generators of the input signal processing stages.

FLIGHT DIRECTOR INSTRUMENTS - TROUBLE SHOOTING

WARNING : OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in fight or on the ground to be quickly rectified. The defect can be isolated with the aid of trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified. Check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Prepare

A. Make certain that the following Captain and First Officer switches are placed in the correct positions.
INS/RAD (Ref. 34-45-00, Trouble Shooting)
ATT INS1/ATT INS3 (Ref. 34-45-00, Trouble Shooting)
COMP1/COMP2 (Ref. 34-21-00, Trouble Shooting)
DEV1/DEV2 (Ref. 34-55-00,34-36-00, Trouble Shooting)
NAV INS1/NAV INS2 (Ref. 34-45-00, Trouble Shooting)
FD1/FD2 (Ref. 22-10-00, Trouble Shooting)
in accordance with function by function trouble shooting of HSI and ADI indicators described in the systems Trouble Shooting procedure.

NOTE : Although the indicator self-tests are included in the Trouble Shooting procedures, the HSI self-test only concerns the heading channel, the ADI self-test concerns the roll and pitch channels only.

B. Switching. State of the systems before start-up (Ref. 34-23-00, Adjustment/Test).

3. Trouble Shooting

A. ADI

```
****************************************************
* The 3 INS systems are in operation. G flap is not *
* visible on ADI indicators. Perform Captain (First *
* Officer) ADI self-test. Press and hold TEST push- *
* button, G flag appears, drum moves ten degrees    *
* nose up, roll mechanism, moves drum ten degrees to*
* right. Release TEST push-button IF.               *
****************************************************
   ||    |
   ||    |     ----------------------------------------
   OK    NOT OK----| Replace ADI [1], ([2])                |
   ||              ----------------------------------------
   ||
----------------------------------------------------
| On Captain (First Officer) control column wheel   |
| turn PITCH ATTITUDE PRESETTING potentiometer in   |
| clockwise (counterclockwise) direction. Attitude  |
| presetting marker rises following the potentio-   |
| meter scale graduations. IF                       |
----------------------------------------------------
   ||    |
   ||    |     ----------------------------------------
   OK    NOT OK----| Replace ADI [1], ([2]), repeat above  |
   ||              | procedure.                            |
   ||              ----------------------------------------
   ||                 |
   ||              NOT OK
   ||                 |
   ||              ----------------------------------------
   ||              | Replace PITCH ATTITUDE PRESETTING pot-|
   ||              | entiometer on Captain (First Officer) |
   ||              | control column handwheel [5], ([6]).  |
   ||              ----------------------------------------
   ||
----------------------------------------------------
| Position potentiometer at clockwise (counterclock-|
| wise) stop. Attitude presetting marker disappears |
| - upper stop at 20° nose up position - Return pot-|
|   entiometer to 0 position. Turn potentiometer in |
|   counterclockwise (clockwise) direction. Attitude|
|   presetting marker descends following the potent-|
|   iometer scale graduations. Return potentiometer |
|   to 0 position. Check that control is smooth and |
|   without rough spots.                            |
----------------------------------------------------
   ||    |
   OK
```

```
   ||      |
   ||      |
   ||      |     ----------------------------------------
   ||      |     | Replace PITCH ATTITUDE PRESENTING pot-|
   OK    NOT OK----| entiometer on Captain (First Officer) |
   ||            | control column wheel.                |
   ||            ----------------------------------------
   ||
-----------------------------------------------------
| ATTITUDE COMPARISON: REF. 34-45-00, TROUBLE SHOOT-|
| ING                                               |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| CHECK ATT WARNING LIGHTS: REF. 34-46-00, TROUBLE  |
| SHOOTING                                          |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| FLIGHT DIRECTOR FUNCTIONS: REF. 22-10-00, TROUBLE |
| SHOOTING                                          |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| RADIO ALTIMETER FUNCTION: REF. 34-42-00, TROUBLE  |
| SHOOTING                                          |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| ILS FUNCTION: REF. 34-36-00, TROUBLE SHOOTING     |
-----------------------------------------------------
```


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B. HSI

```
*****************************************************
* The 3 INS systems are in operation. HDG flag is   *
* not visible on HSI indicators. Perform Captain    *
* (First Officer) ADI self-test. Press and hold TEST*
* push-button, HDG flag appears. Heading dial turns *
* in clockwise direction. Digital indicators display*
* all eights. Release TEST push-button.             *
*****************************************************
   ||    |
   ||    |    ----------------------------------------
   OK    NOT OK----| Replace HSI [3], ([4])               |
   ||         ----------------------------------------
   ||
-----------------------------------------------------
| INSTRUMENT HEADING COMPARISON WARNING:            |
|                 Ref. 34-46-00, Trouble Shooting   |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| HDG FLAG REMAINS VISIBLE - INS MARKER- 1 (2)      |
| MARKER IS NOT VISIBLE: Ref. 34-45-00, Trouble     |
| Shooting                                          |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| RAD MAG MARKERS - 1 (2) MARKER IS NOT VISIBLE:    |
|                 Ref. 34-55-00, Trouble Shooting   |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| VOR LATERAL GUIDANCE FUNCTION, VOR TEST:          |
|                 Ref. 34-55-00, Trouble Shooting   |
-----------------------------------------------------
   ||
```

```
   OK
   ||
-----------------------------------------------------
| INS FUNCTION, NAVIGATION TEST:                    |
|                 Ref. 34-45-00, Trouble Shooting   |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| ILS FUNCTION, ILS TEST                            |
|                 Ref. 34-36-00, Trouble Shooting   |
-----------------------------------------------------
   ||
   OK
   ||
-----------------------------------------------------
| NAVIGATION FUNCTION, TRK/HDG, selected HEADING or |
| TRACK pointer and marker                          |
-----------------------------------------------------
```

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] Captain ADI		2-211	1F23	Flt. Cpt	34-23-12 R/I	34-45-03
[2] 1ST Officer ADI		2-212	2F23	Flt. Cpt	34-23-12 R/I	34-45-03
[3] Captain HSI		2-211	1F22	Flt. Cpt	34-23-11 R/I	34-45-08
[4] 1ST Officer		2-212	2F22	Flt. Cpt	34-23-11 R/I	34-45-08
[5] Captain pitch attitude presetting potentiometer		8-211	F27	Flt. Cpt	34-23-15 R/I	34-45-03
[6] 1ST Officer attitude presetting potentiometer		4-212	F136	Flt. Cpt	34-23-15 R/I	34-45-03

R

Component Identification
Table 101

FLIGHT DIRECTOR INSTRUMENTS - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) On Captain instrument panel (2-211) place ATT/INS (1F7) and NAV/INS (1F33) switches in position 1.

(3) On First Officer instrument panel (2-212) place ATT/INS (2F7) and NAV/INS (2F33) switches in position 2.

(4) Switch on electronics rack ventilation system (Ref. 21-21-00).

(5) Start up INS (Ref. 34-45-00, Adjustment/Test).

(6) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV INS 1ST PLT SW SUP	1-213	1F 34	E15
DEV IS2 1ST PLT SW SUP		1R 38	G14
ATT/INS 1ST PLT SW SUP		1F 13	G16
FD1/FD2 1ST PLT SW SUP		1C 27	Q15
ADI 1ST PLT INS1 SUP & IND	2-213	1F 15	A 7
HSI TRUE 1ST PLT INS1 SUP & IND		1F 21	B 6
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
FLT CONT & NAV BUS 14XS		X 355	H 2
FD1/FD2 2ND PLT SW SUP	5-213	2C 27	A13

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH DASH INST LTS SUP	13-215	L 372	A12
ADI 2ND PLT INS2 SUP & IND	13-216	2F 15	C13
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 4
NAV/INS 2ND PLT SW SUP	15-216	2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
DEV IS2 2ND PLT SW SUP		2R 38	F21

(7) Using LH DASH INSTRUMENTS knob on panel 12-211, check that integral lighting on Captain HSI and ADI varies, then place knob in OFF position.

(8) Using RH DASH INSTRUMENTS knob on panel 5-212, check that integral lighting on First Officer HSI and ADI varies, then place knob in OFF position.

C. Tests

NOTE : - Check that when INS warnings are cancelled, HDG flag disappears on both HSI and G flag disappears on both ADI.
- The tests described concern only checks of the HSI heading channel, ADI roll and pitch channels. The indications of other auto-monitored information presented are normally checked with the systems of which the indicator concerned is the indicating device.

(1) Captain HSI self-test

(a) On Captain HSI, press and hold TEST push-button.

- HDG flag appears
- indicator dial turns anticlockwise
- digital indicators display all eights

NOTE : If the 3 INS units and inertial signal com-

parator unit (ISCU) are in operation, with the 2 ATT INS and NAV INS switches in INS 1 position, HDG warning light illuminates on the Captain and First Officer HSI.

(b) Release test push-button

- digital indicators return to original value
- HDG flag disappears
- indicator dial returns to initial position
- HDG warning lights extinguish, if illuminated

(2) First Officer HSI Self-Test

- Procedure is identical with that described in paragraph 1-C-(1).

(3) Captain ADI self-test

(a) On Captain ADI press and hold TEST push-button.

- G flag appears
R - sphere moves ten degress nose up
R - sphere moves ten degrees right bank.

NOTE : If the three INS units and the comparator (ISCU) are in operation 2, switches ATT INS and NAV INS in INS 1 position, CHECK ATT indicator light illuminates on Captain and First Officer ADI units

(b) Release test push-button

- G flag disappears
R - Sphere returns to zero position (pitch and roll)
- CHECK ATT indicator lights extinguish, if illuminated

(4) First Officer ADI self-test

(a) Procedure is identical with that described in paragraph 1-C-(3).

(5) Check pitch attitude presetting knob

(a) On Captain control column handwheel, turn knob clockwise

- Captain ADI marker rises and moves according to graduations on button
- turn knob to clockwise stop

Captain ADI marker disappears
Stop is at greater than 20° in climb

(b) Return knob to zero

- Marker returns to zero

(c) Turn knob anticlockwise

- ADI marker descends and moves according to graduations on knob
- minimum stop is at 10° descent
- make certain that during rotation, control is smooth

(d) On First Officer control column handwheel :

Check procedure as for Captain control column, paragraphs 1-C-(5)-(a) to 1-C-(5)-(c) inclusive. Indications are read on First Officer ADI. Rotate knob in opposite sense to Captain handwheel knob.

D. Close-Up

(1) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(2) Switch off INS (Ref. 34-45-00, Adjustment/Test).

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

A. The test procedure is identical initially with that for operational test (Ref. para 1), and continues as follows :

R B. Switch on compass couplers (Ref. 34-21-00, Adjustment/Test).

C. Carry out the following checks :

(1) On panel 5-211, place RAD/INS switches in RAD position.

(a) Check on HSI that MAG and RAD markers are visible.

(b) By means of VOR/LOC REF selector switch on AP/FD control unit check that desired track or heading pointers indicate the same value as that indicated in the window above VOR/LOC REF switches.

(2) Place RAD/INS selectors in INS position.

(a) Check that TRUE and INS markers on HSI are visible, and that GS flag and pointer disappear.

R (b) On Captain and First Officer instrument panels, place NAV INS 1/NAV INS 2 switches in NAV INS 1 position.

R - Check that marker 1 is visible in annunciator
R on both HSI

(c) Place NAV INS 1/NAV INS 2 switches in NAV INS 2 position.

R - Check that marker 2 is visible in annunciator
R on both HSI

(3) On panel 5-211, place TRK/HDG 1 and 2 push-pull knobs on AP/FD in PUSH TRK position. Make certain that no mode is engaged.

(a) The HDG flags having disappeared on both HSI
R check that :
R - LIN and TRK markers are visible.
R - TO or FROM arrow marker is visible.
R - drift pointer is visible.

(b) Return TRK/HDG 1 and 2 push-pull knobs to PULL HDG position.
Check that HDG warning lights become visible.

R (4) Switch on radio altimeters (Ref. 34-42-00, Adjustment/

Test).

(a) Check that ALT flag on both ADI disappears, and
R that trapezoidal radio altitude index is tangential to the aircraft symbol.

R (5) On Captain instrument panel, switch on FD1/FD2.

R (a) Check on Captain ADI that FD computer number follows switching.

R (6) On First Officer instrument panel, switch on FD1/FD2.

R (a) Check on First Officer ADI that FD computer number follows switching.

D. Close-Up

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(2) Switch off INS (Ref. 34-45-00, Adjustment/Test).

R (3) Switch off compass couplers (Ref. 34-21-00, Adjustment/Test).

R (4) Switch off radio altimeters (Ref. 34-42-00, Adjustment/
R Test).

(5) Switch off electronics racks ventilation (Ref. 21-21-00).

(6) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

3. System Test

Test procedure is identical with functional test procedure.

At termination of test, a check of indicators and their associated systems can be undertaken. The function by function check of indicators is listed in the following table :

	DESCRIPTION	PART NO.
R	Autopilot (Servicing)	22-10-00 Page 301
R	COMPASS COUPLER (Adjustment/Test)	34-21-00 Page 501
R	ILS (Adjustment/Test)	34-36-00 Page 501
R	RADIO ALTIMETER (Adjustment/Test)	34-42-00 Page 501
R	INS (Adjustment/Test)	34-45-00 Page 501
R	ISCU (Adjustment/Test)	34-46-00 Page 501
R	VOR (Adjustment/Test)	34-55-00 Page 501

HORIZONTAL SITUATION INDICATOR (HSI) - REMOVAL/INSTALLATION

1. General

Two indicators are installed in the aircraft, one on the Captain main instrument panel, the other on the First Officer main instrument panel. Because of insufficient wiring length the indicators cannot be directly removed from the front.
Removal of this instrument may be neccessary to permit removal of other instruments.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On Captain (12-211) and First Officer (5-212) side panels, make certain that LH and RH DASH INSTRUMENTS potentiometer knobs are in OFF position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
HSI TRUE 1ST PLT INS1 SUP & IND	2-213	1F 21	B 6
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
FLT CONT & NAV BUS 14XS		X 355	H 2
LH DASH INST LTS SUP	13-215	L 372	A12
HSI MAG 2ND PLT INS2 SUP & IND	13-216	2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
NAV INST BUS 13XS		X 345	G 4
RH DASH INST LTS SUP		L 371	E 9

C. Remove (Ref. Fig. 401)

(1) Loosen and remove the four adaptor plate (8) mounting screws (6).

(2) Remove adaptor plate (8).

(3) Carefully remove indicator (5) from its seating (2). Support indicator.

(4) Under instrument panel, disconnect indicator connectors (1).

(5) Withdraw indicator (5).

(6) Cap connectors (1) and (4).

D. Preparation of replacement component.

(1) Make certain that indicator seating is clean and that connectors and aircraft wiring are in correct condition.

(2) Visually check that indicator is in correct external condition, that connectors are undamaged and have no traces of corrosion.

E. Install

(1) Remove blanking caps from connectors (1) and (4).

(2) Position indicator (5) facing its seating (2) and carefully install.

(3) Under instrument panel, connect aircraft connectors (1) to indicator receptacles (4).

(4) Push indicator (5) fully against instrument panel (3).

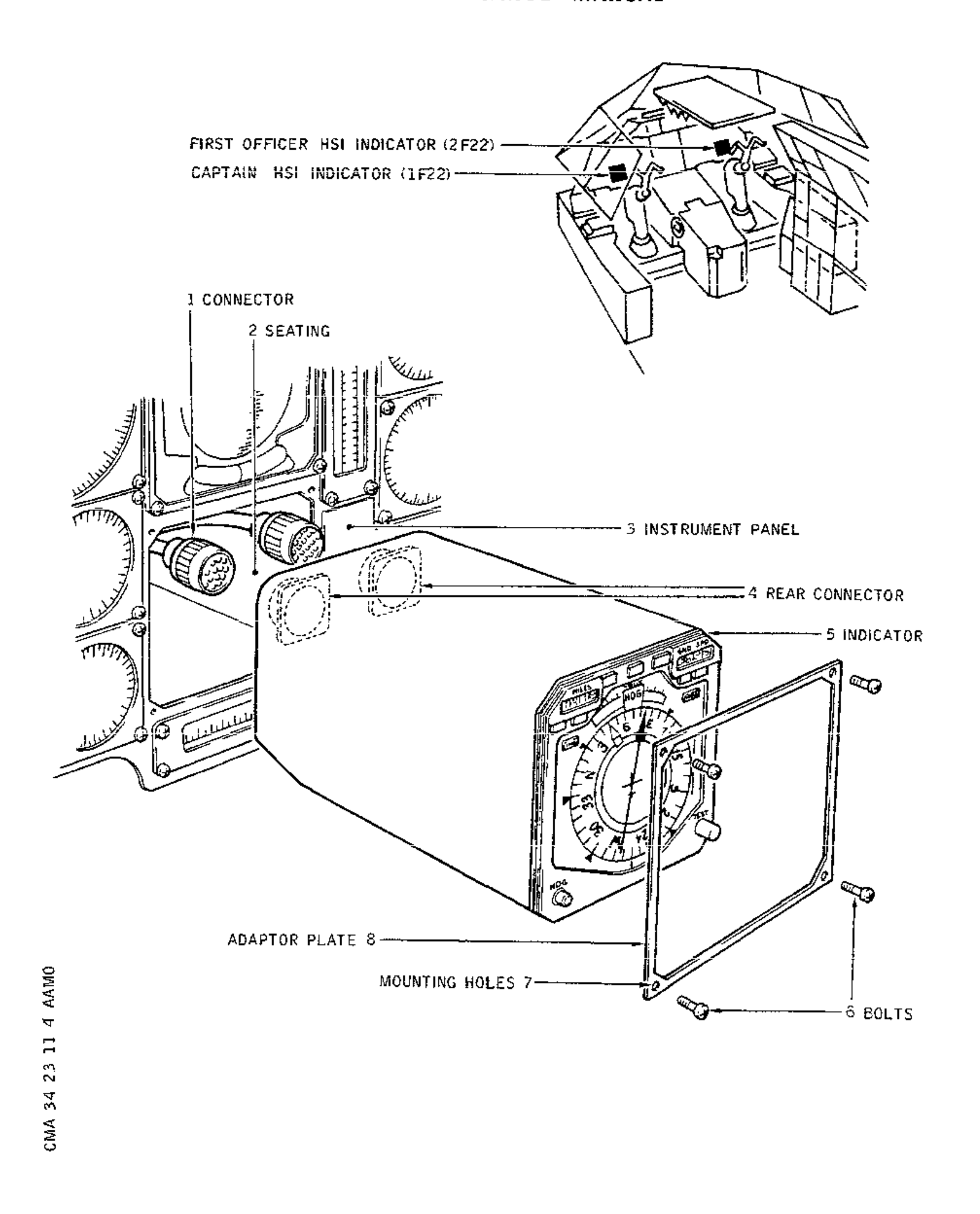
(5) Position adaptor plate (8) and install and tighten 4 mounting screws (6) in adaptor plate holes (7).

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2-B-(2).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

R (3) Switch on electronics rack ventilation system



Removal/Installation of an HSI Indicator
Figure 401

(Ref. 21-21-00).

(4) On side panels 12-211 and 5-212 adjust LH and RH DASH INSTRUMENTS potentiometers and check that indicator illumination varies.

(5) Press and hold TEST push-button on Captain (First Officer) HSI indicator and check that :
- HDG flag appears
- heading dial turns in clockwise direction
- digital indicators display all eights.

(6) Release TEST push-button :
- digital indicators return to original values
- HDG flag disappears
- heading dial returns to its initial position.

(7) On side panels 12-211 and 5-212 return LH and RH DASH INSTRUMENTS potentiometers to OFF position.

G. Close-up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit. (Ref 24-41-00, Servicing).

R (3) Trip the following circuit breakers :

R

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R	FLT CONT & NAV BUS 14XS		X 355	H 2
R	NAV INST BUS 13XS		X 345	G 4

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ATTITUDE DIRECTOR INDICATOR (ADI) - TROUBLE SHOOTING

1. Inertial Comparator Tilting of ADI spheres

It is possible during ground testing for both ADI spheres to tilt 90° pitch down. This effect is similar to an airbone incident caused by a faulty Inertial Comparator. It is possible to generate this effect on the ground for a short duration only. In this case each sphere is tilted individually appearing as a "double ADI tilt" but in fact the system is serviceable. The conditions necessary to create this double ADI tilt are :

A. INS 1 and 2 attitude warning with all three INS's operating.

B. ADI attitude discrepancy (CHECK ATT) as given by the Inertial Comparator.

C. INS 3 giving no attitude warning.

Condition A. exists when the INS system is in alignment number 9, the STANDBY mode. Condition B may arise, for example, when a new ADI is fitted. Condition C is met, normally when the alignment number goes down to 8.

Thus if all INU's are switched on and INS 3 reaches alignment number 8 before INU's 1 and 2, then if the ADI's have an attitude discrepancy of more than 4°, both ADI's will have the spheres tilted 90° pitch down. They will return to normal as each associated INU reaches alignment number 8.

ATTITUDE DIRECTOR INDICATOR (ADI) - REMOVAL/INSTALLATION

1. General

Two indicators are installed on the Captain (2-211) and First Officer (2-212) instrument panels. As the wiring length is sufficient, these indicators can be directly removed from the front of the instrument panels.
Removal of this indicator may be necessary to permit removal of other equipment.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On Captain and First Officer instrument panels 12-211 and 5-212 make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADI 1ST PLT INS1 SUP & IND	2-213	1F 15	B 7
AP/FD SYS1 SUP		1C 20	C 5
ADI PLTS INS3 SUP & IND		3F 15	D 7
FLT CONT & NAV BUS 14XS		X 355	H 2
LH DASH INST LTS SUP	13-215	L 372	A12
AP/FD SYS 2 SUP	13-216	2C 20	A17
ADI 2ND PLT INS2 SUP & IND		2F 15	C13
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 4

C. Remove (Ref. Fig. 401)

(1) Loosen and remove the four adaptor plate (8) mounting screws (6).

(2) Remove adaptor plate (8).

(3) Carefully release and remove indicator (5) from its seating (2).

(4) Disconnect aircraft connectors (1) from indicator receptacles (4).

(5) Cap connectors (1) and (4).

D. Preparation of Replacement Component

(1) Make certain that indicator seating is clean and that connectors and aircraft wiring are in correct condition.

(2) Visually check indicator for correct external condition, that connectors are undamaged and have no traces of corrosion.

E. Install

(1) Remove blanking caps from connectors (1) and (4).

(2) Position indicator (5) facing its seating (2), connect aircraft connectors (1) to indicator receptacles (4).

(3) Engage indicator in its seating and push fully against instrument panel (3).

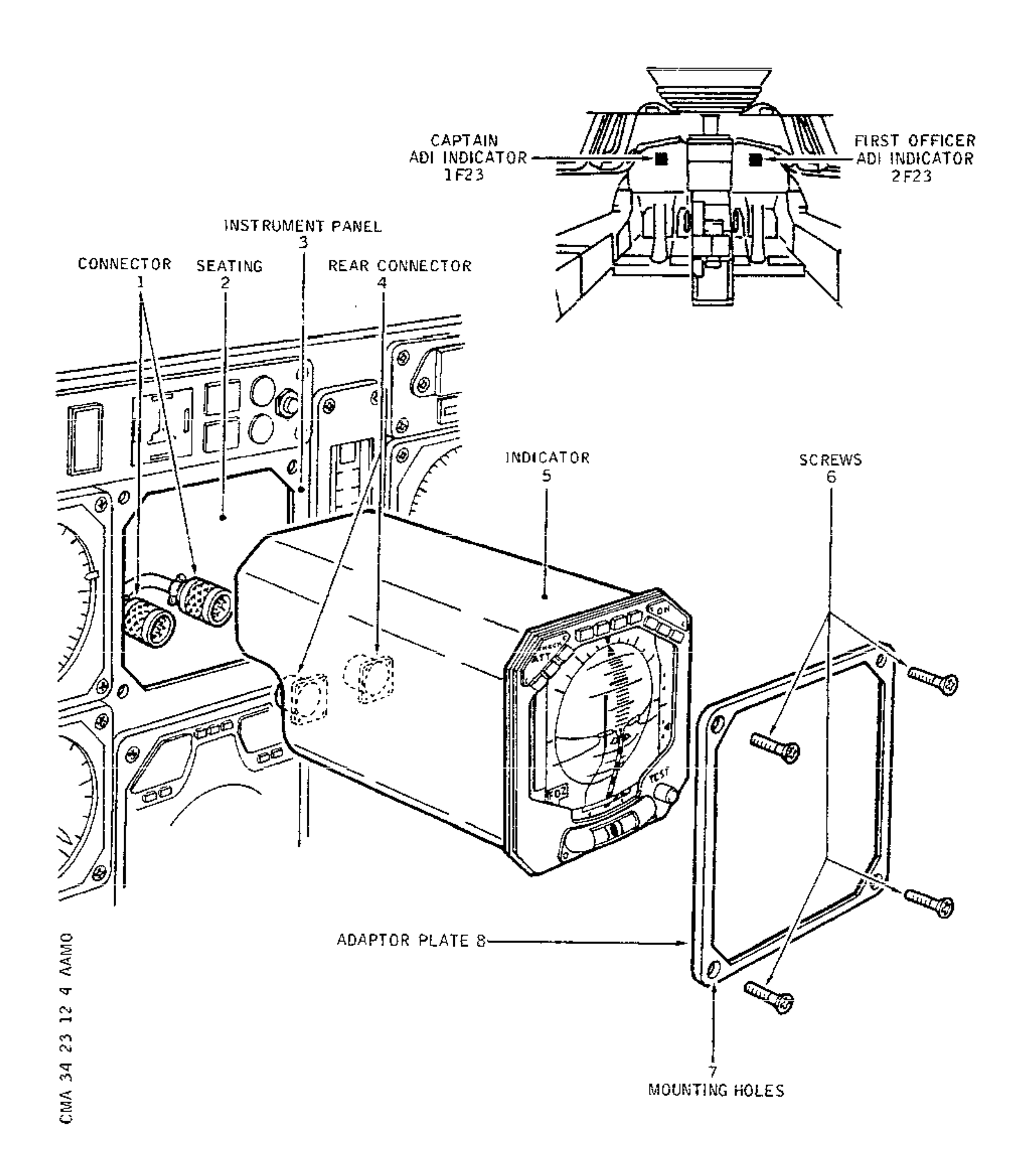
(4) Position adaptor plate (8) and install and tighten 4 mounting screws (6) in adaptor plate holes (7).

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2-B (2).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).



Removal/Installation of an ADI Indicator
Figure 401

(4) Adjust LH DASH INSTRUMENTS, panel 12-211 or RH DASH INSTRUMENTS, panel 5-212 potentiometer and check that illumination varies on indicator faces.

(5) Press and hold TEST push-button on Captain (First Officer) ADI indicator and check that :

- G flag appears
- drum rotates 10° nose up
- drum rotates 10° roll to right

(6) Release TEST push-button
- G flag disappears
- drum returns to zero position (pitch and roll)

(7) On panels 12-211 and 5-212 place LH and RH DASH INSTRUMENTS potentiometers in OFF position.

G. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(3) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

R

VOR-ILS & RAD-INS SWITCHING UNITS 1F24 & 2F24 REMOVAL/INSTALLATION

1. General

VOR-ILS & RAD-INS switching units 1F24 and 2F24 are rack mounted equipment.
VOR-ILS1/VOR-ILS2 & RAD INS switching unit 1F24 is installed on shelf 7-215.
VOR-ILS2/VOR-ILS1 & RAD INS switching unit 2F24 is installed on shelf 5-216.

2. Removal/Installation

As the VOR-ILS & RAD-INS switching units are identical, removal/installation of VOR-ILS1/VOR-ILS2 & RAD INS switching unit 1F24 only will be described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	-
Blanking Caps	-

B. Prepare

(1) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV INS 1STPLT SW SUP	1-213	1F 34	E15
RAD INS 1STPLT SW SUP		1F 26	G17
HSITRUE 1STPLT INS1 SUP & IND	2-213	1F 21	B 6
HSI MAG 1STPLT INS1 SUP & IND		1F 16	B 8
NAV INS 2ND PLT SW SUP	15-216	2F 34	C 2
RAD INS 2ND PLT SW SUP		2F 26	E21
HSI MAG 2ND PLT INS2 SUP & IND	13-216	2F 16	C14
HSITRUE 2ND PLT INS2 SUP		2F 21	C15

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.

& IND

(2) Remove panel DS from shelf 7-215 (panel ES from shelf 5-216 for switching unit 2F24).

C. Remove switching unit 1F24

(1) Gain access to shelf 7-215 (shelf 5-216 for switching unit 2F24).

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.D. (1).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.F. (1).

F. Tests

(1) Carry out a test of switching unit installed.

(2) Refer to 34-45-00, System Test (TRUE HEADING COMPARISON and MAGNETIC HEADING).

(3) Refer to 34-55-14, Adjustment/Test.

G. Close-Up

(1) Install panel DS on shelf 7-215 (panel ES on shelf 5-216 for switching unit 2F24).

(2) Refer to 34-45-00, Adjustment/Test, Operational Test, paragraph 1.D.

(3) Refer to 34-55-14, Adjustment/Test, paragraph D.

PITCH ATTITUDE PRESETTING POTENTIOMETER - REMOVAL/INSTALLATION

1. General

WARNING : OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DESCRIBED IN 24-00-00, SERVICING.

Pitch attitude is preset on the 2 ADI indicators by means of a potentiometer controlled by a graduated knob on the Captain control column handwheel RH arm (F27) for the Captain ADI, and on the First Officer control column handwheel LH arm (F136) for the First Officer ADI.
Removal/Installation procedure is identical for each potentiometer and only the procedure for the Captain control column handwheel will be described.

2. Pitch Attitude Presetting Potentiometer

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
R Special Materials (Ref. 20-30-00, R No.111)	
R Special Materials (Ref. 20-30-00, R No.120)	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADI 1ST PLT INS 1 SUP & IND	2-213	1F 15	A 7
ADI 2ND PLT INS 2 SUP & IND	13-216	2F 15	C13
ADI PLT INS 3 SUP & IND	2-213	3F 15	A 8

C. Remove Pitch Attitude Presetting Potentiometer

(Ref. Fig.401 and 402)

(1) Place and hold graduated knob (1) on Captain control column handwheel in 0 position opposite reference line on base (6).

(2) Loosen and remove screw (2).

(3) Remove graduated knob (1) and spring washer (3).

(4) Remove the 3 countersunk head screws (4) attaching base (6) to handwheel.

(5) Withdraw base (6) and attached potentiometer (9).

(6) Disconnect the 4 electrical connections between potentiometer and Captain ADI.

D. Preparation of Replacement Component

(1) Make certain that replacement component is in correct condition : coloured graduations on knob, screw and clamp, potentiometer, black coating and mechanical limit stops.

NOTE : THE PITCH ATTITUDE PRESETTING KNOBS HAVE DIFFERENT TYPES OF BASE, GRADUATED KNOBS AND POTENTIOMETERS AND ARE IDENTIFIED BY PART NO.

E. Install Pitch Attitude Presetting Potentiometer

(1) Disassemble graduated knob (1) of replacement component, positioning the 0 marker opposite reference line on base. Hold in this position.

(2) Loosen and remove screw (2).

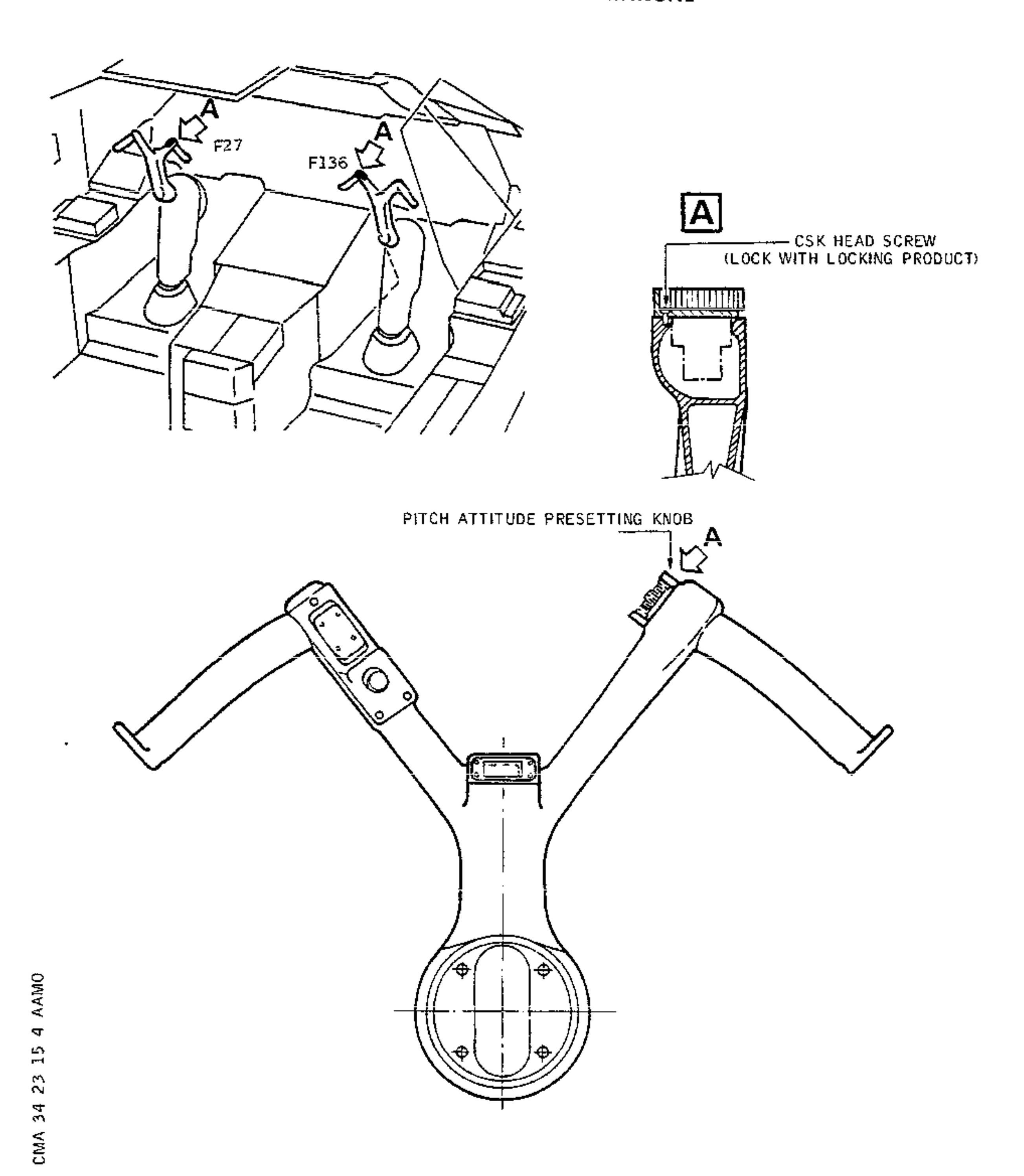
(3) Remove graduated knob (1) and spring washer (3).

(4) Connect the 4 electrical connections between potentiometer and Captain ADI.

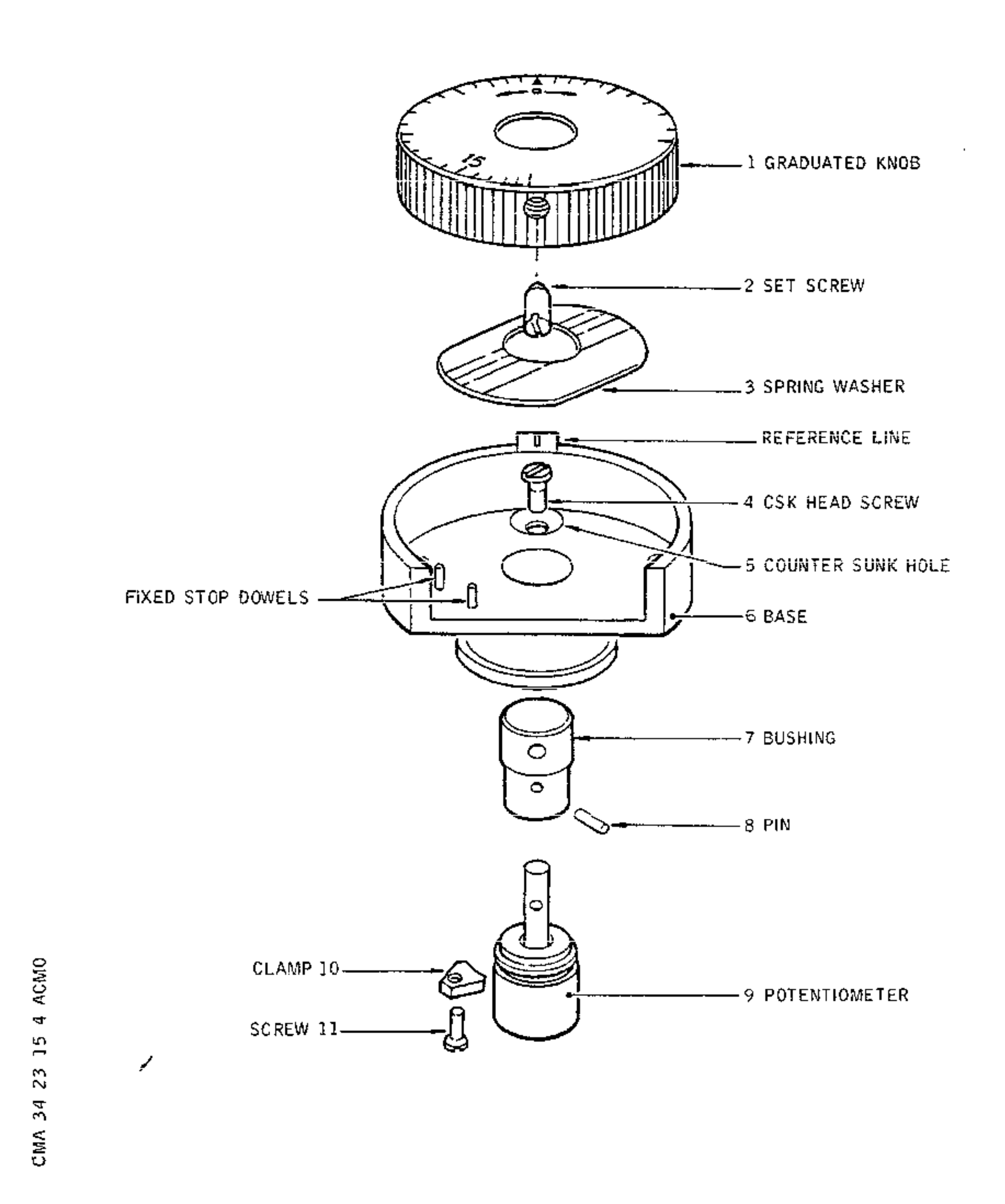
(5) Insert potentiometer in its housing in control column handwheel.

(6) Attach base by means of the 3 countersunk head screws (4) to upper part of housing in control column handwheel. (Install screws and lock using products listed in paragraph A and 20-25-11).

(7) Position spring washer (3) and graduated knob (1),



Captain Control Column Handwheel
Figure 401



Pitch Attitude Presetting Knob
Figure 402

lock by means of setscrew (2).

F. Test

(1) Carry out check (Ref. 34-23-00).

G. Close-Up

(1) Reset circuit breakers previously tripped in 2. B. (1).

(2) Carry out Close-Up procedure in Operational test (Ref. 34-23-00, Adjustment/Test).

RAD - INS SWITCH - REMOVAL/INSTALLATION

1. General

Captain RAD - INS switch 1F 25 is located on Captain instrument panel, panel 1/5 211.
First Officer RAD - INS switch 2F 25 is located on First Officer instrument panel, panel 2/5 212.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD/INS 1STPLT SW SUP		1F 26	G17
RAD/INS 2ND PLT SW SUP		2F 26	E21

C. Remove RAD-INS switch

(1) Refer to 33-16-00, Removal/Installation, for electro-luminescent (EL) panel.

(2) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

D. Preparation of Replacement Component

Not applicable.

E. Install

(1) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

(2) Refer to 33-16-00, Removal/Installation, for EL panel.

F. Tests

(1) Refer to 33-10-00, Adjustment/Test, Close-Up for typical toggle switch.

(2) Check switch operation by carrying out RAD - INS switch test procedures (Ref. 34-45-00, Adjustment/Test, System Test. (TRUE HEADING COMPARISON and MAGNETIC HEADING).

(3) Refer to 33-16-00, Removal/Installation, paragraph 2.G. (1) through (5) for EL panel.

G. Close-Up

(1) Refer to 34-45-00, Adjustment/Test, Operational Test, Paragraph 1.D.

TRACK HEADING UNIT - REMOVAL/INSTALLATION

1. General

Track heading unit (THU) 1F142 is located on lower shelf of LH electronics rack, sub-zone 10-215. THU 2F142 is located on lower shelf of RH electronics rack, sub-zone 10-216.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Ventilation Outlet Blanking Plate	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
HSI MAG 1ST PLT INS1 SUP& IND	2-213	1F 16	B 8
HSI TRUE 1ST PLT INS SUP& IND		1F 21	B 6
APFD SYS1 SUP		1C 20	C 5
FLT CONT & NAV BUS 14XS		X 355	H 2
RAD INS 1ST PLT SW SUP	1-213	1F 26	G17
HSI MAG 2ND PLT INS2 SUP& IND	13-216	2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
APFD SYST2 SUP		2C 20	A17
NAV INST BUS 13XS		X 345	G 4
RAD INS 2ND PLT SW SUP	15-216	2F 26	E21

C. Remove THU 1F142

(1) Remove panel 215AS to gain access to lower shelf, sub-

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zone 10-215.

(2) Loosen the two rack securing screws on THU front panel until they are free from rack.

(3) Gently pull out THU to disconnect rear connector from rack connector.
Continue to pull out THU until it is completely free from rack slides.

(4) Cap connectors
- on rack
- on THU.

(5) Install blanking plate on free ventilation outlet.

D. Preparation of Replacement Component

(1) Make certain that rack is clean and that rack connector is in correct condition.

(2) Visually check replacement component for correct condition. Make certain that rear connector is undamaged, with no trace of corrosion.

E. Install

(1) Remove blanking caps and plate
- from ventilation outlet.
- from rack connector.
- from THU rear connector.

(2) Position THU on rack slides and slide slowly in, making certain that guide pins engage correctly.

(3) Continue to slide THU in to engage rear connector and rack connector (when THU is fully in, THU front panel must be flush with rack front panel).

(4) Fully tighten THU rack securing screws.

F. Remove/Install THU 2F142

(1) Remove panel 216AS to gain access to lower shelf, sub-zone 10-216.

(2) Repeat steps 2.C.(2) through 2.E.(4) above.

G. Close-Up

(1) Remove safety clips and tags and reset circuit breakers

tripped in paragraph 2.B.(1).

(2) Carry out a THU test (Ref. 34-23-61, Adjustment/Test).

(3) Install panel 215AS for THU 1F142, panel 216AS for THU 2F142.

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TRACK HEADING UNIT - ADJUSTMENT/TEST

1. General

Test to be carried out after removal/installation.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYS 1 SW SUP	1-213	1F 134	F14
COMPASS COUPLER SYS 2	15-216	2F 134	A21

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics racks ventilation system (Ref. 21-21-00).

(4) On panel 5-211, place RAD-INS selector switches in RAD position.

(5) On Captain and First Officer instrument panels, place both COMP1-COMP2 switches in COMP1 position.

C. Test

(1) THU 1F142

(a) On panel 5-211, on AFCS control unit, place Captain HDG/TRK push-pull knob in HDG position (pull).

(b) On Captain HSI, HDG marker at upper right of face is visible.

(c) Turn Captain HDG/TRK push-pull knob.

(d) Check that heading selected index on Captain HSI moves to correspond.

(2) THU 2F142

(a) Repeat steps C.(1) (a) through (d) above, using HDG/TRK push-pull knob on First Officer side of AFCS control unit. Check shall be carried out on First Officer HSI.

D. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00).

ACCELERATION INDICATION - DESCRIPTION AND OPERATION

1. General

The acceleration detection system is an assembly which displays on indicators on the Captain and F/O instrument panels vertical acceleration values measured by accelerometers.

2. System Components

The system consists of two identical assemblies comprising :

- An angle-of-attack and acceleration indicator (1F83) or (2F83)
- An accelerometer (F38) or (F39).

3. Description

A. Indicator-angle-of-attack and acceleration

The angle-of-attack and acceleration indicator is a rectangular unit containing two independent instruments, equipped with servo-mechanisms which control movement of two indicator pointers.

(1) Angle-of-attack indicator section

See 34-11-10, Description and Operation.

(2) Acceleration indicator section (Ref. Fig. 001)

(a) On instrument face are the following :

(a1) An acceleration scale graduated from - 1g to + 3.5 g.

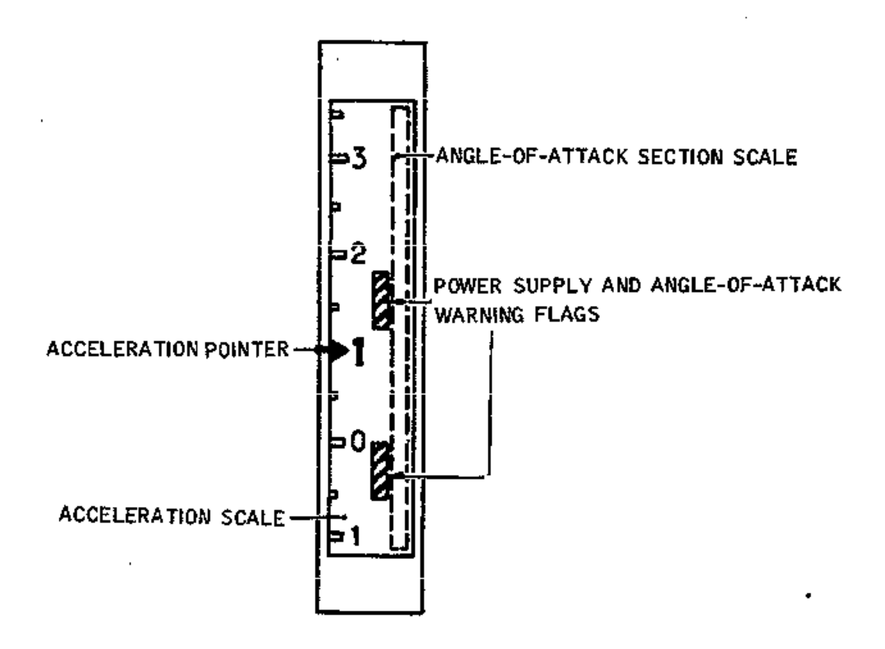
(a2) A pointer which moves in front of scale to indicate acceleration value.

(a3) Two warning flags indicate power module or angle-of-attack section failure.

(b) On rear of instrument, a socket common to the two sections of the instrument is used for connections to the aircraft system.

B. Detector-acceleration, (accelerometer)

The accelerometer is a moving-mass and return spring system, whose function is to measure the vertical component of



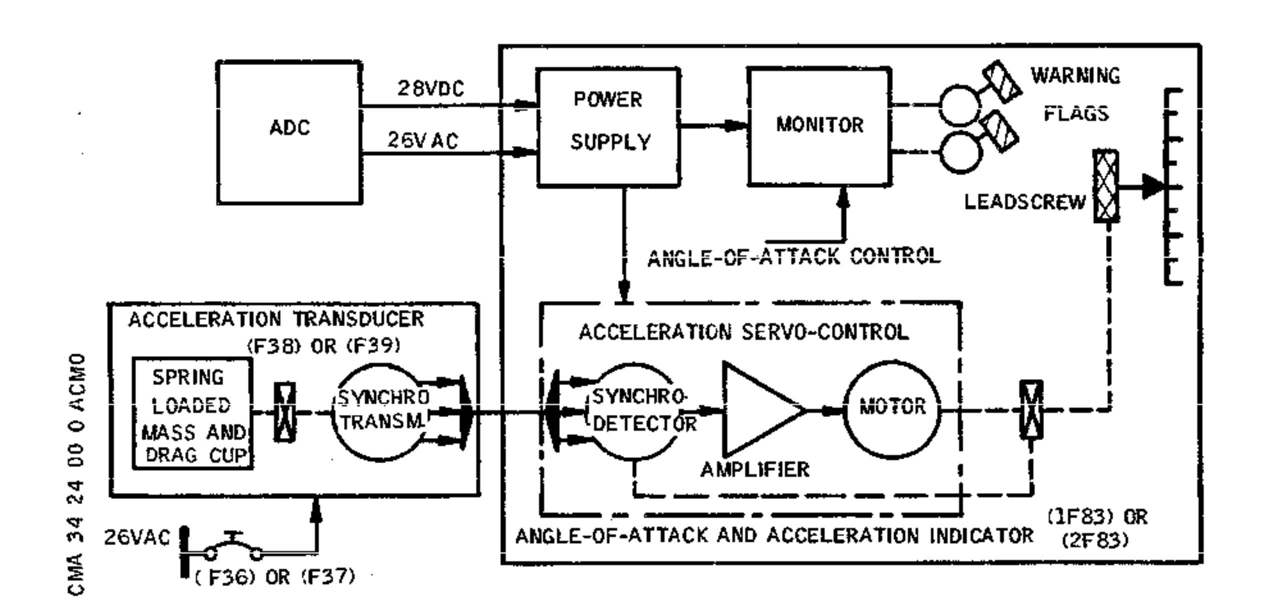
Acceleration Indicator Section : Front View
Figure 001

acceleration and to transmit it to an associated indicator. The detector consists of three separate assemblies :

- A basic mechanism which is essentially a mass compressed by springs
- An eddy current attenuation device
- A synchro-transmitter for the indicator.

4. Operation (Ref. Fig. 002)

Acceleration is detected by two springs fitted into masses which drive a gear train integral with a common shaft.
The masses are so positioned that their effect is cumulative for the vertical acceleration component, but their effects are cancelled for the horizontal component. An aluminium drag cup is mounted at one end of the shaft, the drag cup rotates in the magnetic field in order to reduce eddy currents.
The other end of the shaft drives a synchro-transmitter of which the output is proportional to detected acceleration.
Synchro-transmitter output is fed to the acceleration indicator pointer servo-control system.
The acceleration servo-system is not monitored, but a power



Acceleration : Unit Operation
Figure 002

supply failure causes appearance of warning flags.

ACCELERATION INDICATION - TROUBLE SHOOTING

CAUTION : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The Table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Prepare

A. On ADC control unit on centre console 9-211, make certain that :

(1) ADC1 and ADC2 ON-OFF switches are in OFF position.

(2) Test selector switches are in NORM position.

B. Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 28V SUP	1-213	1F 74	P12
ADC1 26V SUP	2-213	1F 78	A2
1ST PLT ADC INST SUP		1F 75	B3
1ST PLT ACCELMTR TX SUP		F 36	B5
ADC1 115V SUP		1F 73	F3
FLT CONT & NAV BUS 14XS		X 355	H2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC2 28V SUP	5-213	2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
2ND PLT ACCELMTR TX SUP		F 37	D13
ADC2 26V SUP		2F 78	F14
ADC2 115V SUP		2F 73	F15
NAV INST BUS 13XS		X 345	G4

C. Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

D. Switch on electronics rack ventilation system (Ref. 21-21-00)

3. Trouble Shooting

```
****************************************************
* On centre console, on ADC control unit,          *
* place ADC1 and ADC2 switches in ON position      *
* ADC1 and ADC2 indicator lights illuminate.       *
* Press lights and check that on panels 2-211      *
* and 2-212 that flag on angle-of-attack           *
* and acceleration indicators [1] and [2]          *
* is not visible. IF                               *
****************************************************
        ||         |        ---------------------------------------
        ||         |       | Flag appears on angle-of-attack and  |
        ||         |       | acceleration indicator [1] or [2]    |
        OK         NOT OK----| Ref. Normal Air data computation,  |
        ||                 | (Ref. 34-11-00, Trouble Shooting)    |
        ||                  ---------------------------------------
****************************************************
* On panels 2-211 and 2-212, check that            *
* angle-of-attack and acceleration                 *
R * indicators indicate + 1g ± 0.1g. IF            *
****************************************************
        ||         |        ---------------------------------------
        ||         |       | Angle-of-attack and acceleration     |
        OK         NOT OK----| indicator [1] or [2] does not      |
        ||                 | indicate this value - Refer to       |
        ||                 | Chart 101                            |
        ||                  ---------------------------------------
----------------------------------------------
| Acceleration indication system is opera-   |
| tional                                     |
----------------------------------------------
```

```
*************************************-------------------------------
* ANGLE-OF-ATTACK AND ACCELERATION   *| GROUND EQUIPMENT REQUIRED   |
* INDICATOR DOES NOT INDICATE THE    *|-----------------------------|
* REQUIRED VALUE                     *| DESCRIPTION       PART NO.  |
*************************************|-----------------------------|
                                     | MULTIMETER                   |
                                     -------------------------------

******************************************
* Check 26 VAC output on circuit         *
* breaker [3] or [4]                     *
******************************************
     |        |       ---------------------------------------
     |        |       | Replace circuit breaker [3] or [4]  |
    YES       NO-----------------------------------------------
     |
******************************************
* Replace angle-of-attack and acceleration *
* indicator [1] or [2]                   *
* Repeat test, checking that reading on  *
* acceleration scale is : 1g ± 0.1 g     *
******************************************
              |       ---------------------------------------
              |       | Trip circuit breaker [3] or [4]     |
              NO------| Replace acceleration transducer [5] |
                      | or [6]                              |
                      ---------------------------------------
```

Chart 101

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] Angle of attack and acceleration indicator		2-211	1F83	Flight Compart-ment	34-11-12 R/I	34-24-11
[2] Angle-of attack and acceleration indicator		2-212	2F83	Flight Compart-ment	34-11-12 R/I	34-24-11
[3] Circuit breaker 26VAC		2-213	F36	MAP - REF B5	24-50-00 R/I	34-24-11
[4] Circuit breaker 26VAC		13-216	F37	MAP - REF B14 or D13	24-50-00 R/I	34-24-11
[5] Accelera-tion transdu-cer	Door 145	145	F38	56 and 56B	34-24-16 R/I	34-24-11
[6] Accelera-tion transdu-cer	Door 145	145	F39	56 and 56B	34-24-16 R/I	34-24-11

R

Component Identification
Table 101

ACCELERATION INDICATION - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) On ADC control panel, center console 9-211, make certain that :

(a) ADC 1 and ADC 2 ON-OFF switches are in OFF position.

(b) TEST selector switches are in NORM position.

(2) Make certain that the following circuit breakers are closed :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC 1 28 V SUP	1-213	1F 74	P12
ADC 1 26 V SUP	2-213	1F 78	A 2
1ST PLT ADC INST SUP		1F 75	B 3
1ST PLT ACCELMTR TX SUP		F 36	B 5
ADC 1 115 V SUP		1F 73	F 3
FLT CONT & NAV BUS 14XS		X 355	H 2
ADC 2 28 V SUP	5-213	2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
2ND PLT ACCELMTR TX SUP		F 37	D13
ADC 2 26 V SUP		2F 78	F14
ADC 2 115 V SUP		2F 73	F15
NAV INST BUS 13XS		X 345	G 4

(3) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing)

(4) Switch on electronics rack ventilation system (Ref.

21-21-00, Servicing).

C. Tests

(1) On ADC control panel, centre console, 9-211, place ADC 1 and ADC 2 ON-OFF switches in ON position :

(a) On panel 2-211, check that :
- flags on angle-of-attack and acceleration indicator disappear.
- acceleration pointer indicates +1g ± 0.1g.

(b) On panel 2-212, check that :
- flags on angle-of-attack and acceleration indicator disappear.
- acceleration pointer indicates +1g ± 0.1g.

(2) On ADC control panel, place ADC 1 and ADC 2 switches in OFF position, check that :

- On panels 2-211 and 2-212, flags appear on angle-of-attack and acceleration indicators.

D. Close-Up

(1) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(2) Switch off electronics rack ventilation system (Ref. 21-21-00, Servicing).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

Repeat operational test procedure, refer to paragraph 1.

3. System Test

Repeat operational test procedure, refer to paragraph 1.

ACCELEROMETER F38 AND F39 - REMOVAL/INSTALLATION

1. General
(Ref. Fig. 401)

Accelerometers F38 and F39 are located in zone 145, at FR56.

Access to accelerometer F38 is gained through access door 51AZ located in LH main landing gear bay. Access to accelerometer F39 is gained through access door 671AZ located in RH main landing gear bay.

2. Accelerometers F38 and F39

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform 11 ft. 4 in. (3.47 m)	
Corrosion-Resistant Steel Lockwire Dia 0.8 mm (0.032 in.)	

B. Prepare
(Ref. Fig. 401)

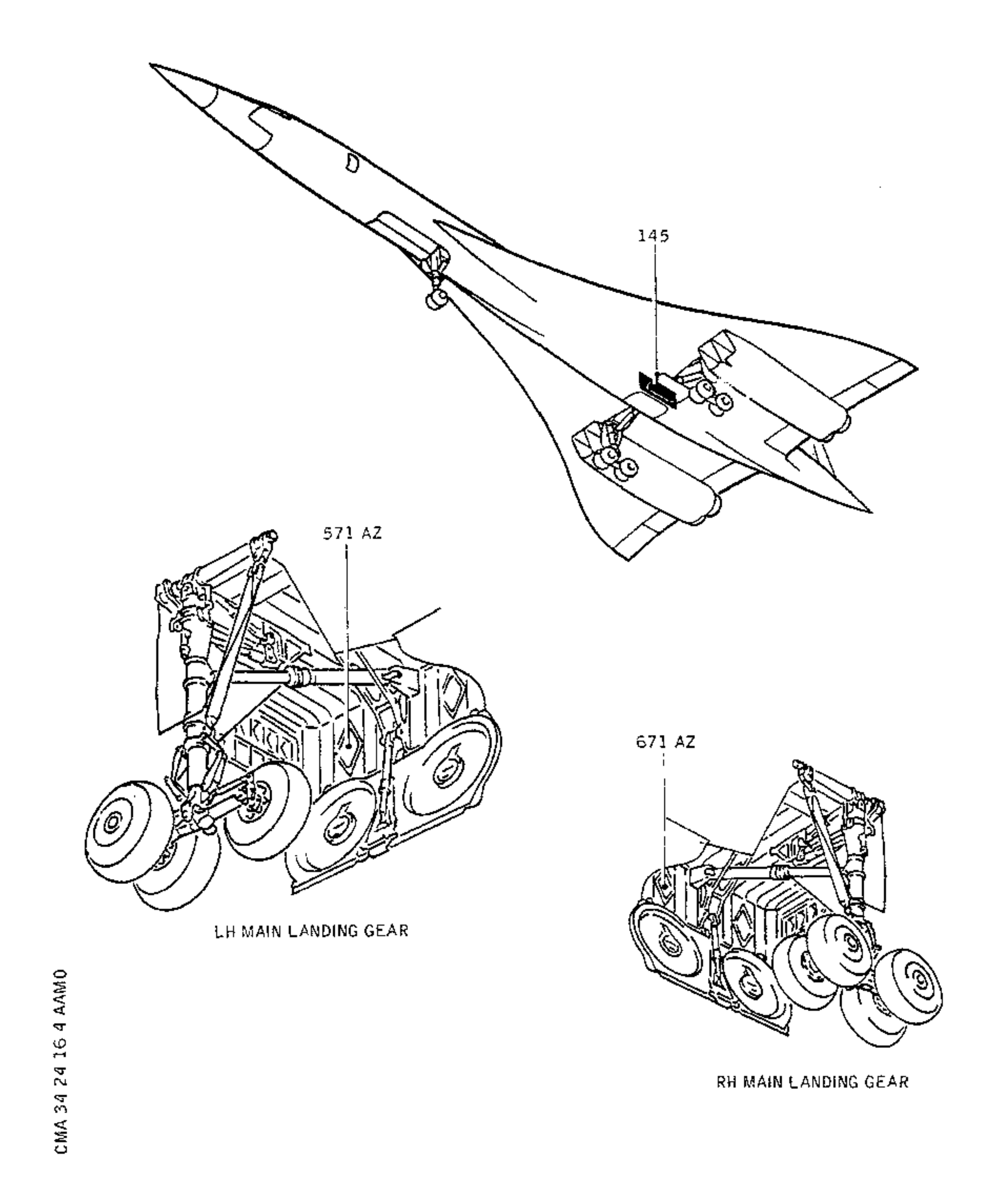
(1) Open main landing gear doors (Ref. 32-00-00, Servicing).

(2) Position access platform.

(3) In LH main landing gear bay open access door 571AZ (RH bay : access door 671AZ).

(4) Trip, safety and tag one of the following circuit breakers, depending on accelerometer to be removed : Circuit breaker F36 for accelerometer F38 (F37 for accelerometer F39) :

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R	1 PLT ACCELMTR TX SUP	02-123	F 36	B 5
R	FLT CONT & NAV BUS 14XS		X 355	H 2
R	2 PLT ACCELMTR TX SUP	03-216	F 37	D13
R	NAV INST BUS 13XS		X 345	G 4



Location of Accelerometers F38 and F39
Figure 401

C. Remove
(Ref. Fig. 402)

(1) In zone 145, in underfloor compartment (access through door 571AZ (671AZ)).

(a) On cable bundles, routes 1M and 2M (3M and 4M),
R break lockwire (1).

(b) Disengage and remove clamps (2).

CAUTION : CABLE BUNDLES RUNNING ALONG ROUTES 1, 2, 3 AND 4 IN WORKING AREA MUST BE PROTECTED AGAINST POSSIBLE DAMAGE TO ELECTRICAL INSULATION.

(2) Install protective sleeves on cable bundles.

(3) Disengage cable bundles gently from supports and push against landing gear bay wall.

(4) On accelerometer F38 (F39)

(a) Disconnect electrical plug F38A (F39A).

(b) Remove the four attachment screws (4) and retain washers.

(5) Remove relevant accelerometer by pulling gently to rear of aircraft.

D. Preparation of Replacement Component

(1) Make certain that accelerometer is in correct condition and that there are no dents, paint scratches or bent or broken pins.

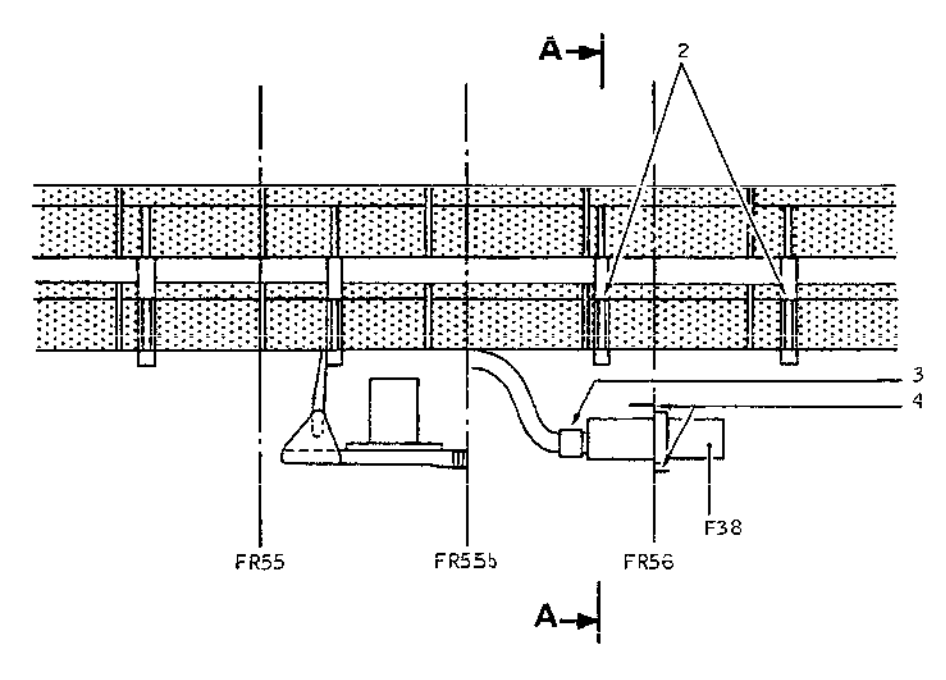
E. Install
(Ref. Fig. 402)

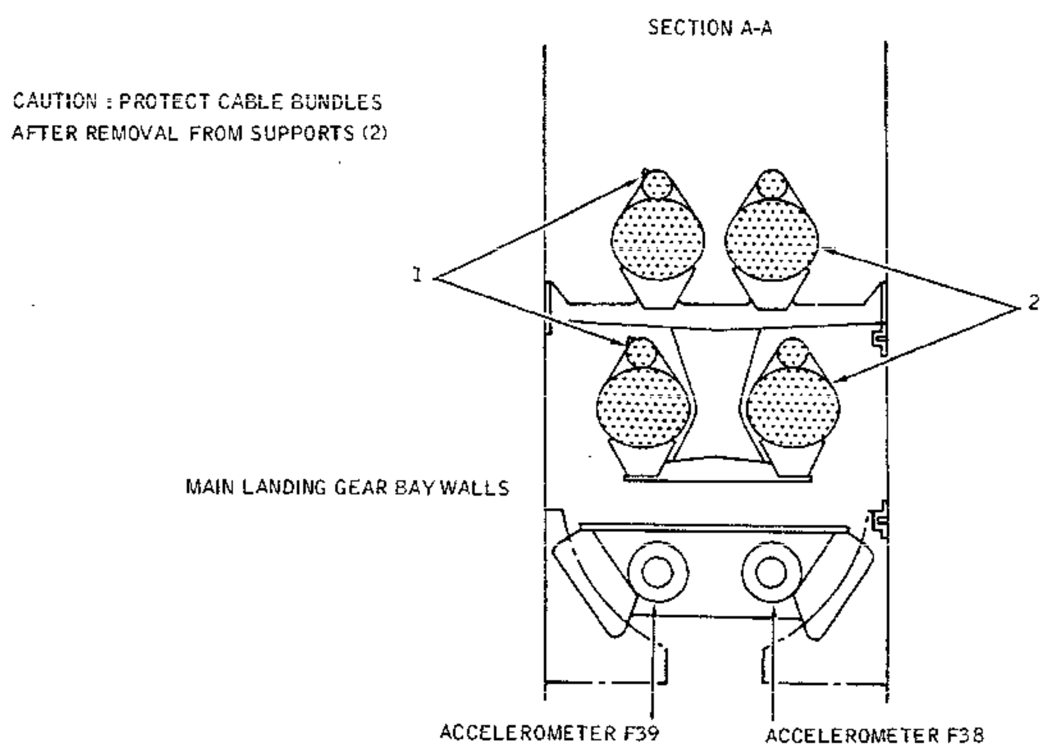
(1) Position accelerometer in housing, following precautions below.

(a) Arrow engraved on rear of accelerometer pointing upwards.

(b) Electrical receptacle to front of aircraft.

(c) Position accelerometer in stop position against support attached to rear of frame 56.





CMA 34 24 16 4 ACMO

Removal of Accelerometers
Figure 402

(2) Install washers on screws and install and tighten the four attachment screws (4).

(3) Connect electrical plug F38A to accelerometer F38 (39A to accelerometer F39).

(4) Remove protective sleeves from cable bundles.

(5) Position cable bundles in supports.

(6) Install and tighten clamps (2) on cable bundle supports.

(7) Wirelock clamp screws as per 20-21-13.

R (8) Reset circuit breakers listed in paragraph B(4).

F. Test

(1) Carry out test as per 34-24-00, Adjustment/Test.

G. Close-Up

CAUTION : MAKE CERTAIN THAT WORKING AREA IS CLEAN AND CLEAR OF TOOLS AND MISCELLANEOUS ITEMS OF EQUIPMENT.

(1) Close access door 571AZ in LH main landing gear bay (access door 671AZ in RH main landing gear bay).

R (2) Remove access platform.

(3) Close main landing gear doors (Ref. 32-00-00, Servicing).

STANDBY COMPASS - DESCRIPTION AND OPERATION

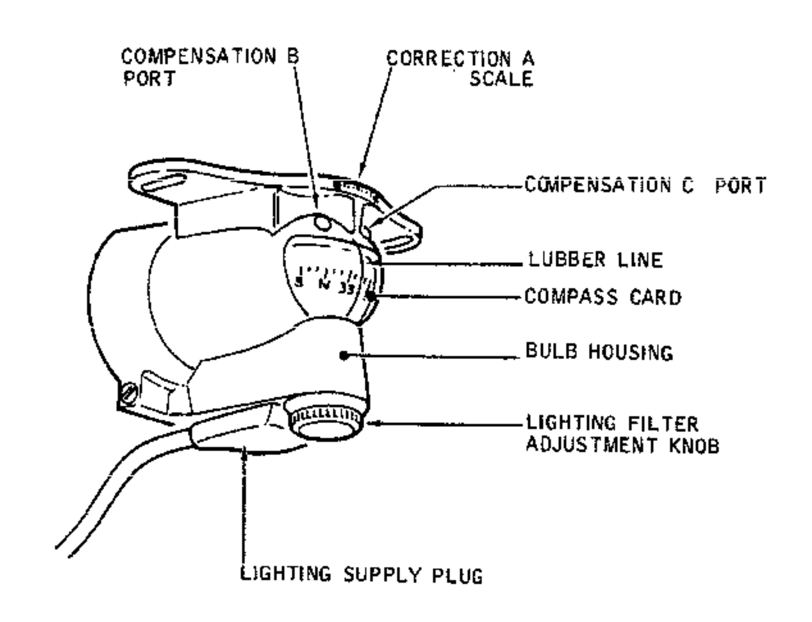
1. General

The standby compass is an independent instrument which provides
R constant heading indication with respect to magnetic North.
R The instrument has two functions

- to provide comparison with the heading displayed on the ins-
R truments by the magnetic navigation systems.
- as a standby in case of magnetic navigation system failure.

The instrument is mounted on the glareshield instrument panel
R and is easily read from the Captain and First Officer positions.
Disturbances caused by stray magnetic fields in the proximity
of the compass can cause reading errors. The compass is compen-
sated against these effects.

2. Standby Compass SMITHS KCA 0105W (Ref. Fig. 001)



CMA 34 25 00 0 AAMO

- Standby Compass : Front View
Figure 001

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A. Description

R The standby compass comprises

R (1) A moving element consisting of

R - a conical section horizontal compass card graduated in tens of degrees.
R - a permanent magnet.
R - a pivot.

R (2) A moulded plastic bowl containing

R - the moving element
R - a damping liquid
R - a bellows mounted at the rear of the bowl which compensates for expansion and contraction of the liquid due to temperature variations.
R - a vertical lubber line engraved on the read window

(3) A housing

R - enclosing the plastic bowl
R - containing in its upper part the horizontal compensation mechanism and in its lower part a non-magnetic lamp and the vertical compensation system.

B. Operation

The standby compass is used to indicate the magnetic heading
R of the aircraft with respect to earth magnetic North.
A magnet mounted on a compass card is aligned along the longitudinal component of the earth magnetic field, the compass card and its magnet turn on a pivot, the assembly floats in a damping fluid. The indication on the compass card (aircraft magnetic heading) is read against a lubber line representing the aircraft longitudinal axis.
A small non-magnetic lamp illuminates the read window through a red or white filter, which can be adjusted by a knurled knob mounted on the lower part of the housing.
R Disturbances caused by stray magnetic fields - aircraft
R structure, hard or mild steel, and electromagnetic field
R effects - can be partially eliminated by compensation
corrections, shielding of conductors, etc...

C. Compensation corrections (magnetic mass disturbances)

R On the upper and lower parts of the housing are compensation mechanisms used to minimise reading errors in the standby compass.

R (1) Upper part of housing

R A plate on which the compensation devices are mounted comprises :

(a) A scale graduated in 5° increments to right and left of a central reference mark enables correction of deviation A. This correction is made by rotation of the compass around its mounting screws up to a maximum of 10° to right or left, in order to bring the lubber line of the instrument into alignment with the aircraft axis.

(b) Below the scale are two apertures marked B and C containing the compensation mechanisms for B and C deviations linked to the East-West and North-South axes. Each compensator moves a small magnetized bar which acts as a correction mechanism in order to minimise the magnetic error due to disturbing masses. The respective position of each bar is repeated by an indicator on the top of the plate.
R In addition, as the error is not constant, a
R compensation table allows the pilot to read the correction to be applied for each heading, in
R order to obtain magnetic heading.

R (2) Lower part of housing

R On the lower part of the housing, a compensation mechanism R enables levelling of the compass card in the horizontal plane, according to aircraft attitude.

STANDBY COMPASS - ADJUSTMENT/TEST

1. General

Standby compass adjustment consists mainly of compensation with the purpose of setting the instrument with respect to the lubber line on the aircraft and to reduce the effects of earth magnetic field distortion caused by the aircraft structure and electrical systems.
The standby compass (F50) is mounted on the glareshield in zone 211.

RB The standby compass check and compensation procedure in
RB paras. 2.A., B., C., D. and E., must be carried out whenever
RB the standby compass is changed.
RB The check swing procedure in paras. 3.A., B., C., and D. is
RB required in the following circumstances:

RB A. Whenever inaccuracies are reported.

RB B. After modification, repair or major replacement involving
RB magnetic materials in the vicinity of the standby
RB compass, as defined by Technical Services.

RB C. If inaccuracy is suspected after the standby compass has
RB been subjected to shock, i.e. heavy landing.

RB D. If inaccuracy is suspected after the aircraft has passed
RB through an electrical storm or been struck by lightning.

RB E. After the aircraft has remained on the same heading for
RB three months.

2. Standby Compass Check and Compensation

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	-
Special key	CE2-10
Tractor	-
Ground Service Telephone	-
Compensation Chart	-

B. Prepare

(1) Position aircraft on compensation base by means of tractor.

(2) On panel 1-213, make certain that circuit breaker STBY COMPASS & ALT SUP (L380), map Ref.P22, is set.

(3) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(4) Switch on electronics rack ventilation system (Ref. 21-21-00, Servicing).

(5) Connect a ground service telephone to nose gear interphone box (R75) and link to tractor.

(6) Make certain that no foreign metallic object is in the standby compass zone of magnetic influence.

(7) Place droop nose on 5° position, visor lowered. (Ref. 27-61-00, Adjustment/Test).

C. Check of Standby Compass Lighting

(1) On LH console 12-211, place COMPASS switch in DIM and BRIGHT positions and check that standby compass lighting operates.

D. Compensation of Standby Compass

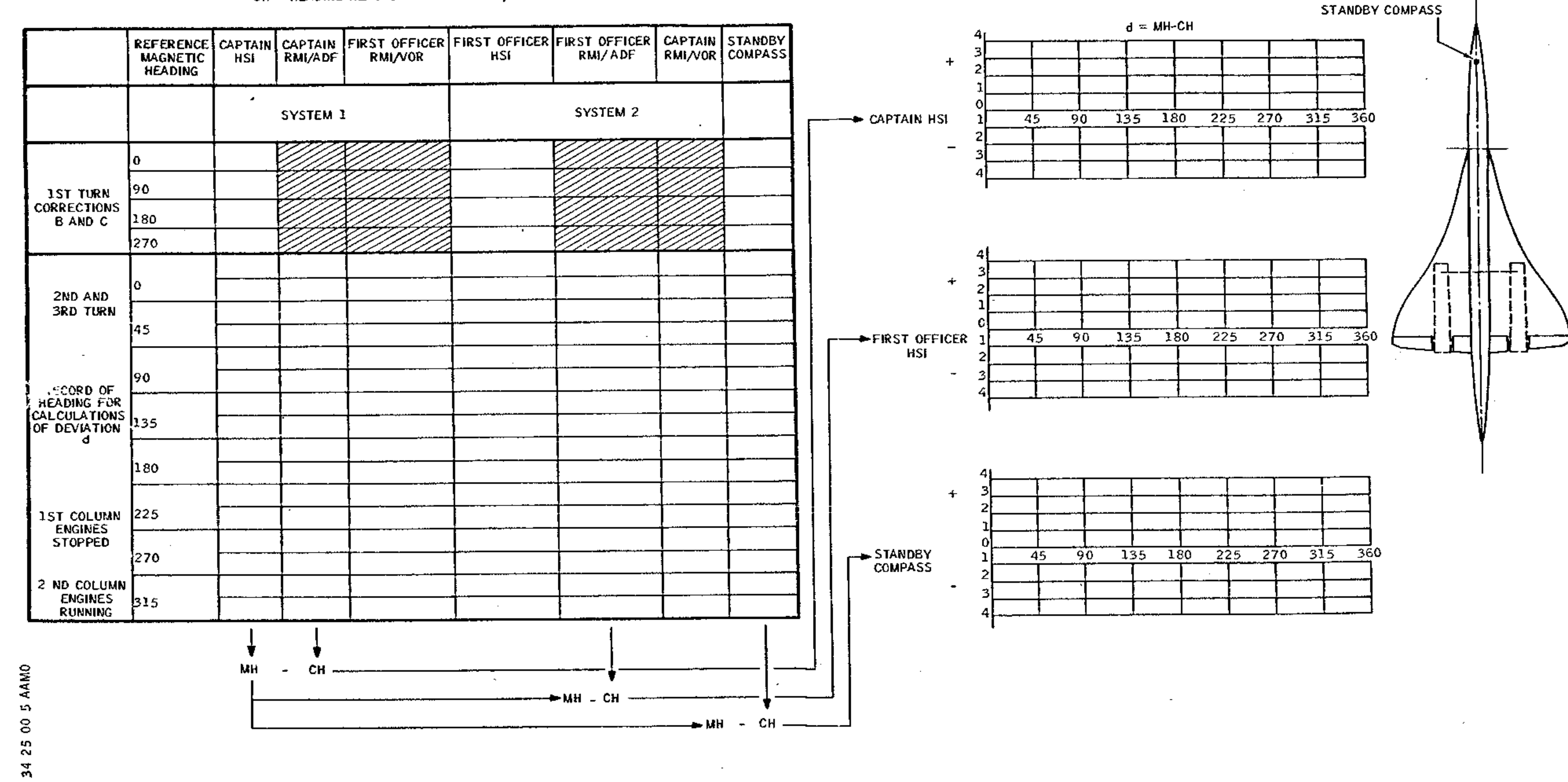
(1) Switch on of systems

All systems must be in operation as well as passenger and crew lighting (Ref. appropriate chapters).
In particular:

(a) Switch on INS 1, 2 and 3 (Ref. 34-45-00, Adjustment/Test).

(2) Calculation of deviation d (compass error)

The aircraft is positioned on magnetic headings North, East, South and West. d is the difference of magnetic heading (mH) - compass heading (cH).
mH is calculated from the INS heading ± the deviation
cH is read on the standby compass.
Note values mH, cH and deviation d on compensation chart (Ref. Fig. 501).



R

Compensation Chart
Figure 501

NOTE: Aircraft is always turned in the same sense. The 4th compensation turn is carried out with engines running.

(3) 1st turn: calculation and correction of component A

(a) Position aircraft on magnetic NORTH, heading 000°, North. Read cH on standby compass, calculate d = mH - cH.

(b) Position aircraft on magnetic EAST, heading 090°, East. Read cH, on standby compass, calculate d.

(c) Position aircraft on magnetic SOUTH, heading 180°, South. Repeat above procedure.

(d) Position aircraft on magnetic WEST, heading 270°, West. Repeat above procedure.

(e) Calculate the algebraic average A of the 4 values of deviation d.

(f) Position aircraft on heading 000°, North.

(g) Loosen the two standby compass mounting screws so as to allow the compass to be turned.

(g1) Turn standby compass by value of A, in opposite sense.

(g2) Tighten mounting screws, check that new heading is equal to previous heading ± correction applied.

(4) 2nd turn: compensation

(a) Position aircraft on magnetic heading 000°, North

(a1) Insert special key in hole C (on front of bowl) and cancel error.

(b) Position aircraft on magnetic heading 090°, East

(b1) Insert special key in hole B and cancel error.

(c) Position aircraft on magnetic heading 180°, South

(c1) Insert special key in hole C and reduce error by half.

(d) Position aircraft on magnetic heading 270°, West

(d1) Insert special key in hole B and reduce error by half.

(5) 3rd turn: deviation curve readings

(a) Position aircraft on magnetic heading 000°, North. Read standby compass heading, calculate d = mH - cH

(a1) Read those values at intervals of 45°, turning aircraft in the same sense until aircraft returns to initial heading mH 000°, North.

(b) Plotting of deviation curve.

(6) 4th turn: reading of standby compass headings with engines running.

(a) Position aircraft on magnetic heading, 000°, North

(a1) Read standby compass headings at intervals of 45°.

(b) Plot the values on compass deviation card on windshield centre post (Ref. 34-25-21, Removal/ Installation).

E. Close-Up

(1) Shut down engines.

(2) Shut down all systems, switch off lighting.

RB 3. Standby Compass Check Swing

RB A. Equipment and Materials

	DESCRIPTION	PART NO.
RB	Electrical Ground Power Unit	-
RB	Tractor	-
RB	Ground Service Telephone	-
RB	Compass Deviation Card from the check swing aircraft	-

B. Prepare

(1) Prepare as detailed in para. 2.B.

C. Standby Compass Check Swing

(1) Check conditions: engines not running. All other systems must be in operation as well as passenger and crew lighting (Ref. appropriate chapters).

In particular:

(a) Switch on INS 1, 2 and 3 (Ref. 34-45-00, Adjustment/Test).

(2) With the droop nose set at 5° and the visor down, position the aircraft at magnetic North, heading 000°, check that the compass reading at North is the same as that given in the 5°/visor down column on the aircraft's compass correction card. Repeat the comparison check at East (090°) South (180°) and West (270°).

NOTE: The aircraft must always be turned in the same sense.

(3) If any heading noted during the check swing is not within ± 1° of the appropriate heading recorded on the correction card, then carry out the full Standby Compass Check and Compensation procedure in para 2.

(4) Raise the nose and visor to their up positions (Ref. 27-61-00). Repeat the procedure in para. 3.C.(2) comparing the check swing headings with the nose/visor up column on the correction card.

D. Close-Up

(1) Shut down all systems, switch off.

DEMAGNETIZATION OF AIRCRAFT STRUCTURE - MAINTENANCE PRACTICES

1. General

A. Errors in the heading reference given by the standby compass may be caused by magnetization of the visor location fittings mounted R on the visor and windscreen centre pillar (Ref. 27-61-11, Fig.405). These components and their attachment bolts may become magnetized when the aircraft has been exposed to heavy static charges or has been struck by lightning. Compass errors may vary with changes in aircraft heading and when the visor and droop nose are raised and lowered.

B A hand held compass or a magnetic field indicator may be used to detect the presence of magnetic fields when held in contact with the structure around the visor and windscreens. A calibrated field strength meter (magnetometer) may be used to accurately measure the level of any detected magnetization.

C. Where errors are reported in the standby compass readings and magnetization of the local aircraft structure is detected, the demagnetization procedure should be carried out.

2. Demagnetization Procedure

A. Equipment and Materials

DESCRIPTION	PART NO.
Demagnetizer (AC electromagnetic yoke)	Y6
Magnetic field indicator - dial type	-
Circuit breaker safety clips	-

B. Prepare

(1) Lower the visor and droop nose to gain access to the windscreen (Ref. 27-61-00, Adjustment/Test).

(2) Electrically isolate the visor and droop nose controls by tripping the following circuit breakers. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NOSE 7 1/2 DEG CONT	1-213	M 12	Q16
NOSE/VISOR STBY LOWER SUP		M 13	Q17
VISOR & NOSE CONT	15-215	M 11	F 8

(3) Remove the standby compass (Ref. Removal/ Installation). Note the setting of the correction A scale. Keep the compass in an area away from the demagnetizing process and any other strong magnetic field.

(4) Disconnect electrical ground power from the aircraft (Ref. 24-41-00, Servicing). Ensure both main batteries are selected OFF.

C. Demagnetization (Ref. Fig. 201)

CAUTION: DO NOT OPERATE THE DEMAGNETIZER WITHIN 0.5 METRE OF ANY PARTS OF THE AIRCRAFT OTHER THAN THE AREA WHICH IS TO BE DEMAGNETIZED.

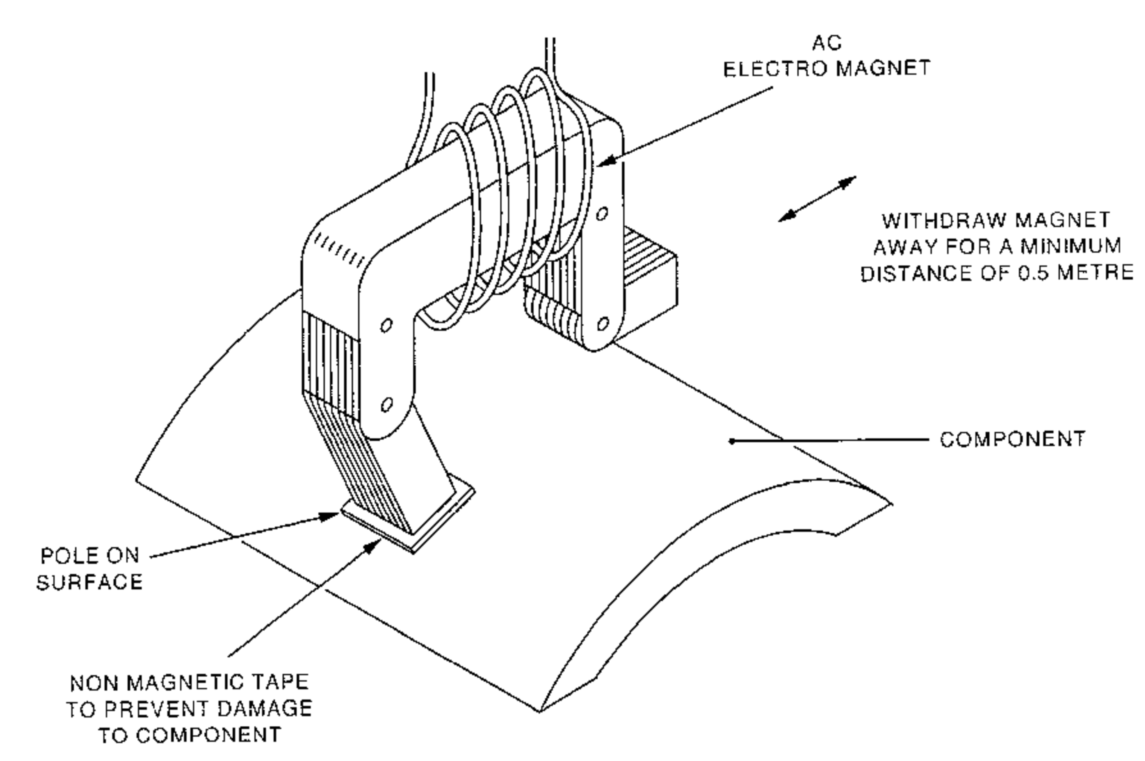
ONLY ONE POLE OF THE DEMAGNETIZER MUST BE APPLIED TO THE AREA WHICH IS TO BE DEMAGNETIZED.

(1) Cover one of the demagnetizer poles which is to be applied to the work area with insulating or masking tape. This is to prevent scoring of the aircraft's surface.

(2) Measure the residual field in the area which is to be demagnetized using a magnetic field indicator. Note the reading. Pay particular attention to steel components and fittings including fasteners and mounting bolts.

(3) Extend the untaped pole of the demagnetizer upwards and place the taped pole on the area to be demagnetized. Switch on the demagnetizer and gradually stroke the taped pole piece across the work area and away for a distance of at least 0.5 metre away from any aircraft structure or equipment. Switch off the demagnetizer.

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Demagnetization Using AC Electrmagnetic Yoke
Figure 201

(4) Measure the residual field in the work area and compare with the initial reading. Repeat the demagnetization process until the desired low level of residual magnetism is reached. It may be necessary to stroke the work area in several different directions.

(5) Switch off the demagnetizer at least 0.5 metre from the aircraft structure.

D. Install

(1) Refit standby compass (Ref. Removal/Installation). Set the correction A scale to the reading taken in para. 2.B.(3).

E. Close-Up

(1) Remove safety clips and reset the previously tripped circuit breakers.

(2) Return the droop nose and visor to the required position (Ref. 27-61-00, Adjustment/Test).

F. Tests

(1) Carry out a test of the standby compass (Ref. 34-25-00, Adjustment/Test).

NOTE: The demagnetization process may have changed the level of residual magnetism which was present in the aircraft structure when the last compass compensation was carried out. A further compensation swing may now be necessary.

STANDBY COMPASS - REMOVAL/INSTALLATION

1. General

The standby compass, F50, is located in the flight compartment, mounted on the windshield centre post.

R 2. Standby Compass

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) On panel 1-213, trip, safety and tag circuit breaker STBY COMPASS & ALT SUP (L380), map ref. P22.

C. Remove Standby Compass
(Ref. Fig. 401)

(1) In flight compartment on windshield centre post :

(a) Hold lead and socket assembly (1) between thumb and forefinger, press lightly and pull downwards to disconnect from compass.

(b) Hold magnetic compass assembly (4) and shield masking (5) with one hand and remove mounting screws (3) and washers.

(c) Remove assembly and separate shield masking (5) from compass (4).

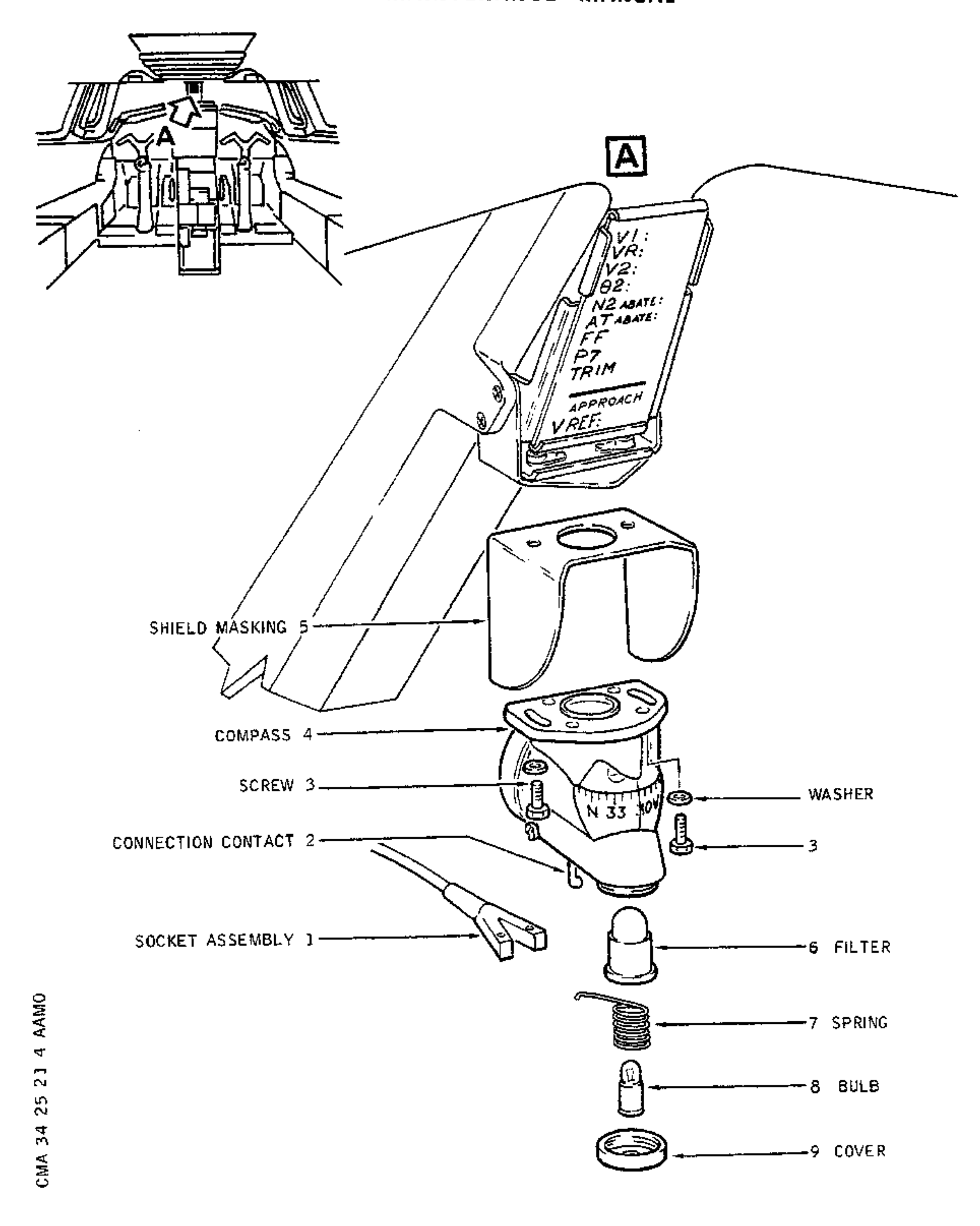
D. Remove Lighting Assembly
R (Ref. Fig. 401)

(1) In flight compartment, on standby compass :

- Remove cover (9) taking care to retain : bulb (8), spring (7) and filter (6).

E. Preparation of Replacement Component

(1) Standby compass.



R

Standby Compass
Figure 401

(a) Make certain that component has no sign of damage, scratched paint or leakage of fluid.

(2) Bulb

(a) Make certain that replacement bulb is of non-magnetic miniature type and that it is of the type specified by the compass manufacturer.

F. Install Standby Compass

(1) In flight compartment on windshield centre post :

(a) Install shield masking (5) and magnetic compass (4).

(b) Install, without tightening, mounting screws (3) and washers.

(c) Position compass so that indicated heading corresponds to aircraft heading on ground.

(d) Tighten mounting screws (3).

G. Install Lighting Assembly

(1) Position spring (7) in filter (6), place bulb on spring (7).

(2) Install filter, spring and bulb assembly on standby compass, tighten cover (9).

(3) Hold lead and socket assembly (1) between thumb and forefinger, press lightly and engage on connection contacts (2) on standby compass.

NOTE : Check that connection is properly made on the two contacts (2).

H. Close-Up

(1) Reset circuit breaker previously tripped in paragraph B. (1).

J. Tests

(1) Standby compass test :

(a) Carry out test (Ref. 34-25-00, Adjustment/Test).

(2) Lighting assembly test

(a) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(b) In flight compartment, on LH side console, place COMPASS switch in DIM or BRIGHT position

- standby compass lighting must come on.

(c) Place COMPASS switch in OFF position

- standby compass lighting must go off.

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing.

R 3. Compass Deviation Card
R (Ref. Fig. 402)

R The compass deviation card is located behind the speed limit
R card, in the speed limit card holder assembly, installed on the
R bracket assembly on windshield centre post.

R A. Remove

R (1) Compass deviation card.

R (a) Remove speed limit card (1) from speed limit card
R holder assembly (6).

R (b) Loosen and remove screws (2), then remove compass
R deviation card.

R (2) Speed limit card holder assembly.

R (a) Loosen and remove top screws (4).

R (b) Remove bracket assembly (5) from speed limit card
R holder assembly (6).

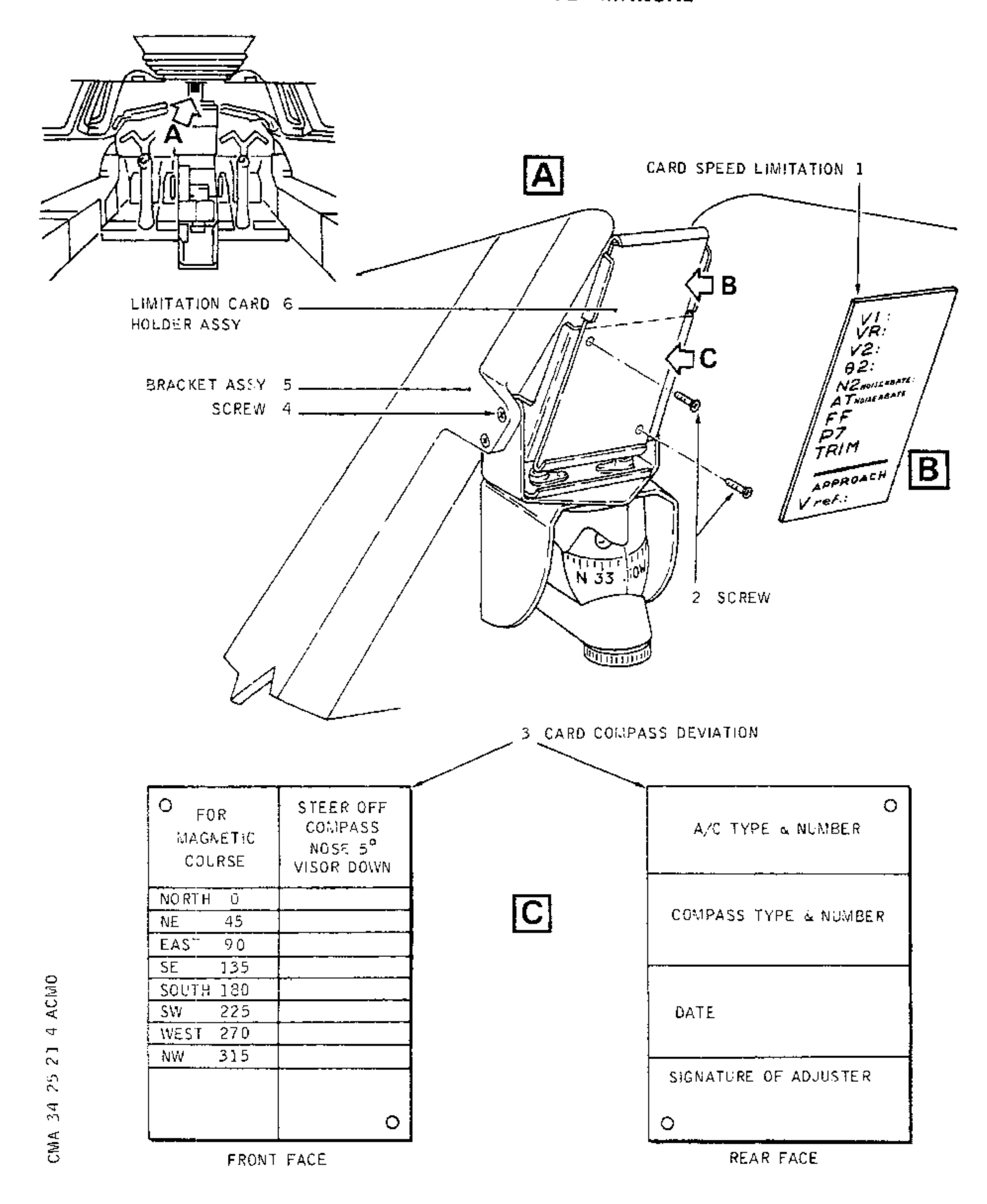
R B. Install

R (1) Speed limit card holder assembly.

R (a) Install speed limit card holder assembly (6) in
R bracket assembly (5).

R (b) Position and tighten top screws (4).

R (2) Compass deviation card.



Card and Speed Limit Card Holder Assembly - Removal/Installation
Figure 402

R (a) Install compass deviation card (3) (front face
R visible) in speed limit card holder assembly (6).

R (b) Attach compass deviation card with screws (2).

R (c) Install speed limit card (1) in speed limit card
R holder assembly.

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LANDING AND TAXIING AIDS - DESCRIPTION AND OPERATION

1. General

Landing and taxiing aids includes all approach, landing and taxiing guidance equipment. It comprises the I.L.S. and marker beacon systems.

2. I.L.S. System

In order to assist the approach and landing, and to properly align the aircraft with a correct rate of descent on the final approach, two ground marker beacons form accurate positioning axes with reference to a runway. These are the LOCALIZER and GLIDE PATH axes (azimuth and descent).
An aircraft equipped with an I.L.S. (Instrument landing system) receives the marker transmissions. The signals received are translated into lateral and vertical guidance information (deviations) with reference to the defined axes. These deviations are displayed on indicators. The pilot makes the corrections necessary to hold the aircraft at the centre of the axes. In the case of automatic landing, the autopilot channels use the guidance information received by the I.L.S. An aural LOCALIZER signal is also available.

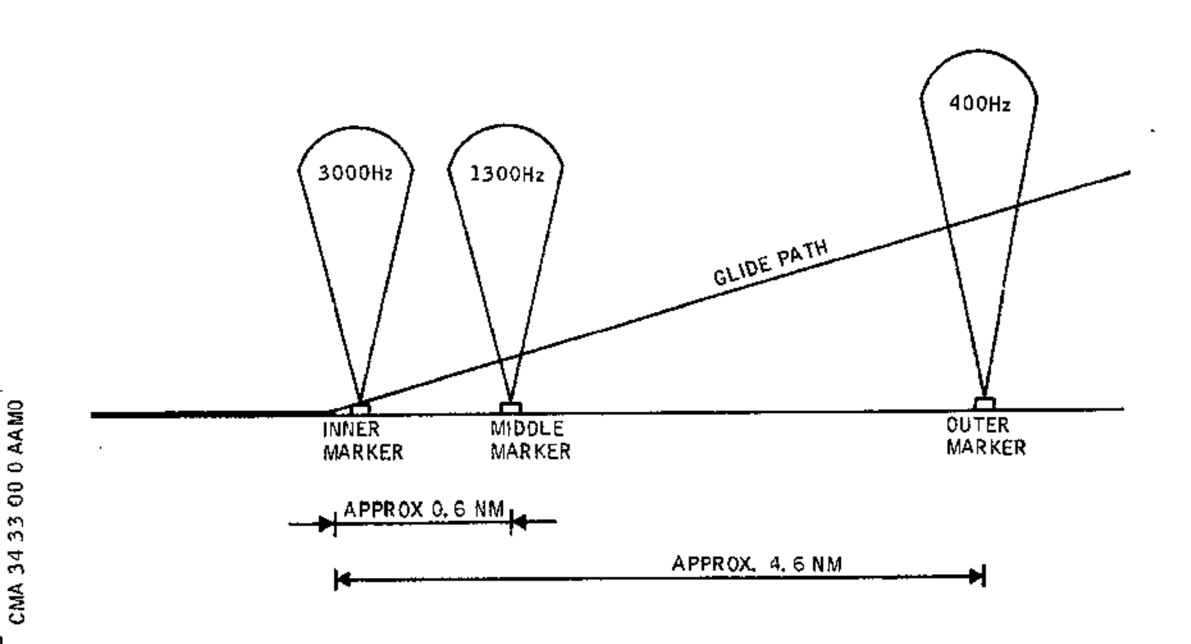
3. MARKER BEACON System

In addition, the pilot has available to him visual indications as the aircraft passes over marker beacons installed in the approach circuit. (The exact positions are published in the aviation guides). A MARKER BEACON receiver in the aircraft receives the transmissions from these beacons and indicates, by illumination of indicator lights, the passage of the aircraft over the beacons. There are three beacons :

- outer marker located approximately 4.6 Nm from the beginning of the runway, the corresponding blue indicator light illuminates - 400 Hz aural identification signal.
- middle marker installed approximately 0.6 Nm from the beginning of the runway, corresponding amber light illuminates - 1300 Hz aural identification signal.
- inner marker installed at the beginning of the runway, the corresponding white indicator light illuminates - 3000 Hz aural identification signal.

R MARKER BEACON SYSTEM - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)



Marker Beacon : Location of Beacons
Figure 001

The marker receiver provides indications of the passage of the aircraft over ground marker beacons. The indications are visual by means of two lamp assemblies, - each having three coloured indicator lights - and audible.
The ground marker beacons operate on a frequency of 75 Mhz, using amplitude modulation. The identification signals are in morse code. Signal modulation frequency depends on the beacon position in the landing configuration. The outer marker, frequency 400 Hz, is located approximately 4.6 Nm from the beginning of the runway. The middle marker, frequency 1300 Hz, is located approximately 0.6 Nm from the beginning of the runway and the inner marker, frequency 3000 Hz is located approximately 100 metres from the beginning of the runway.
The exact location of the marker beacons is given in the aviation guides. The fan (or Z) markers, located at the beginning of the runway are placed in a prominent position and serve as a

navigation aid.

2. System Components

1 Receiver	R40
1 Antenna	R41
1 3 indicator light assembly (Captain) blue-amber-white	R43
1 3 indicator light assembly (Co-pilot) blue-amber-white	R44
1 Sensitivity switch	
1 TEST push-button	

3. Receiver-Marker Beacon, COLLINS 51Z4

A. Description

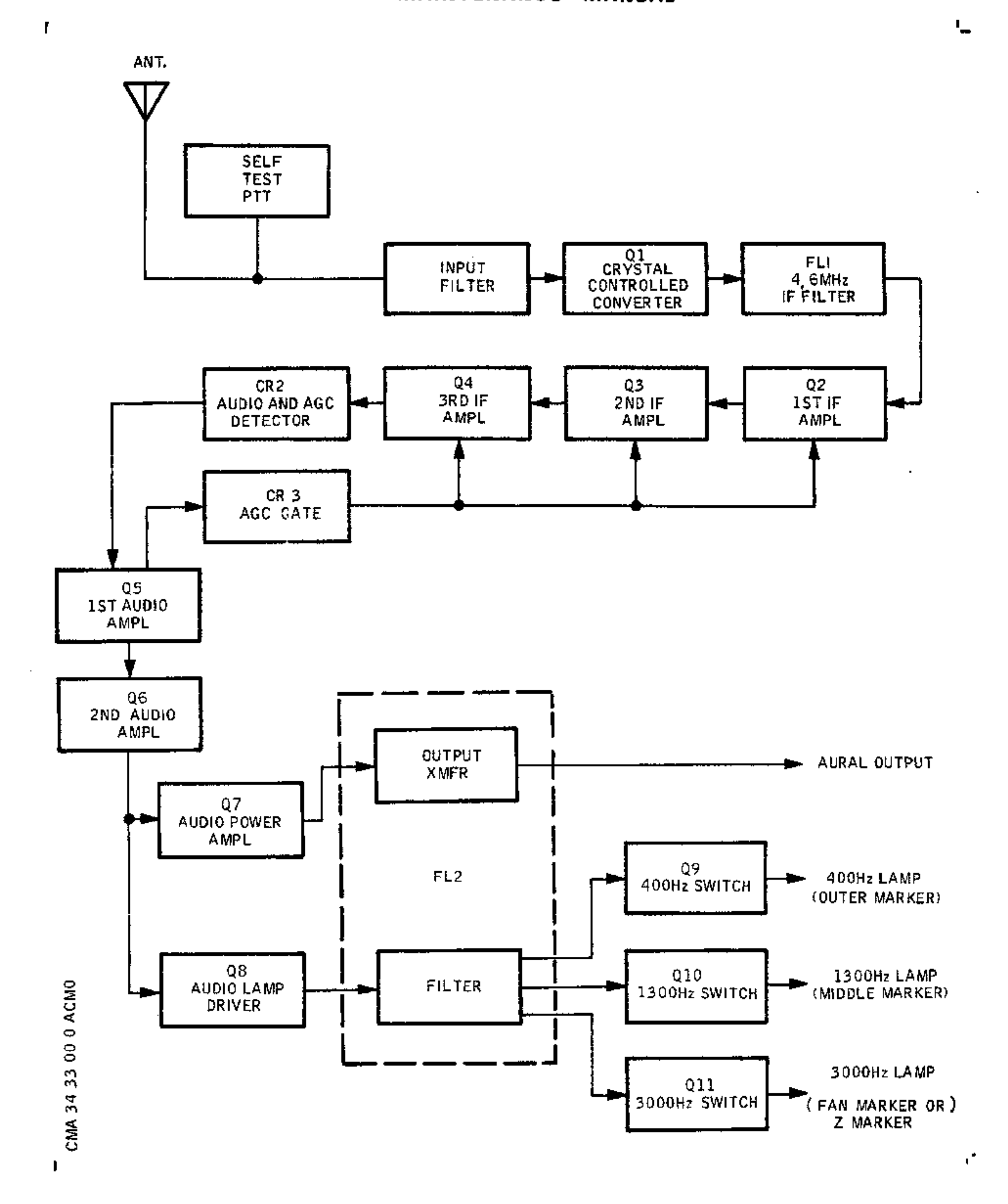
A single I.F. conversion superheterodyne, the marker receiver operates on a fixed frequency of 75 Mhz ± 0.005%. It is contained in a 1/4 ATR short case with a single connector at the rear through which all unit interconnections are made. Unit weight is 3.25 lb including self test assembly.

B. Operation (Ref. Fig. 002)

Depending on the type of beacon overflown by the aircraft, outer, middle or inner, a 75 Mhz signal is received, amplitude modulated by 400, 1300 or 3000 Hz. After being passed through a selective filter the signal is applied to the mixer transistor. The crystal controlled local oscillator has an output frequency of 70.4 Mhz. The resulting 4.6 Mhz I.F. signal is filtered, then passed through three I.F. amplifiers in cascade. The three I.F. stages are controlled by the A.G.C. applied through a time delay to allow reception of weak signals. The demodulated signal is amplified by the audio-frequency stages, transformer coupled to the audio power amplifier and indicator light separation filter. The signal is then available as follows :

(1) At the terminals of the audio output transformer, impedance 600 ohms. The audio frequency output, adjustable by potentiometer, is passed to the interphone.

(2) At the output terminals of three frequency selective transformers, capacitively tuned in the primary windings to 400, 1300 and 3000 Hz respectively. Each of the three transformer secondary windings drives a transistor switch which controls illumination of the indicator light corresponding to the frequency of the received signal.



Marker Receiver - Block Diagram
Figure 002

C. Self-test

The self-test circuit is activated by the test push-button which triggers an astable multivibrator which modulates a 75 Mhz oscillator. The signal is injected into the antenna circuit of the receiver. When the circuit is triggered, the indicator lights are illuminated for 4 to 5 seconds. When the push-button is released the circuit is triggered for a further five seconds. During self-test, the receiver is automatically switched to maximum sensitivity.

4. Antenna-Built-in, STAREC Type 1202

A. General

The antenna is contained in a rectangular housing on the underside of the aircraft.
The receiving element is a metal strip mounted inside the box enclosed in an insulated cavity. It is of small dimensions to match the wavelength.

B. Technical characteristics

Frequency range : 75 Mhz ± 150 Khz
Nominal impedance : 50 ohms
S.W.R. : 5 maximum
Polarisation : Horizontal
Weight : less than 600 g
Fitted with capacitance frequency tuning adjustment.

5. System Operation (Ref. Fig. 003)

A. Reception

The marker receiver is supplied from circuit-breaker (R47). The beacon signal is received at the antenna (R41), processed by the receiver and the output is passed to :

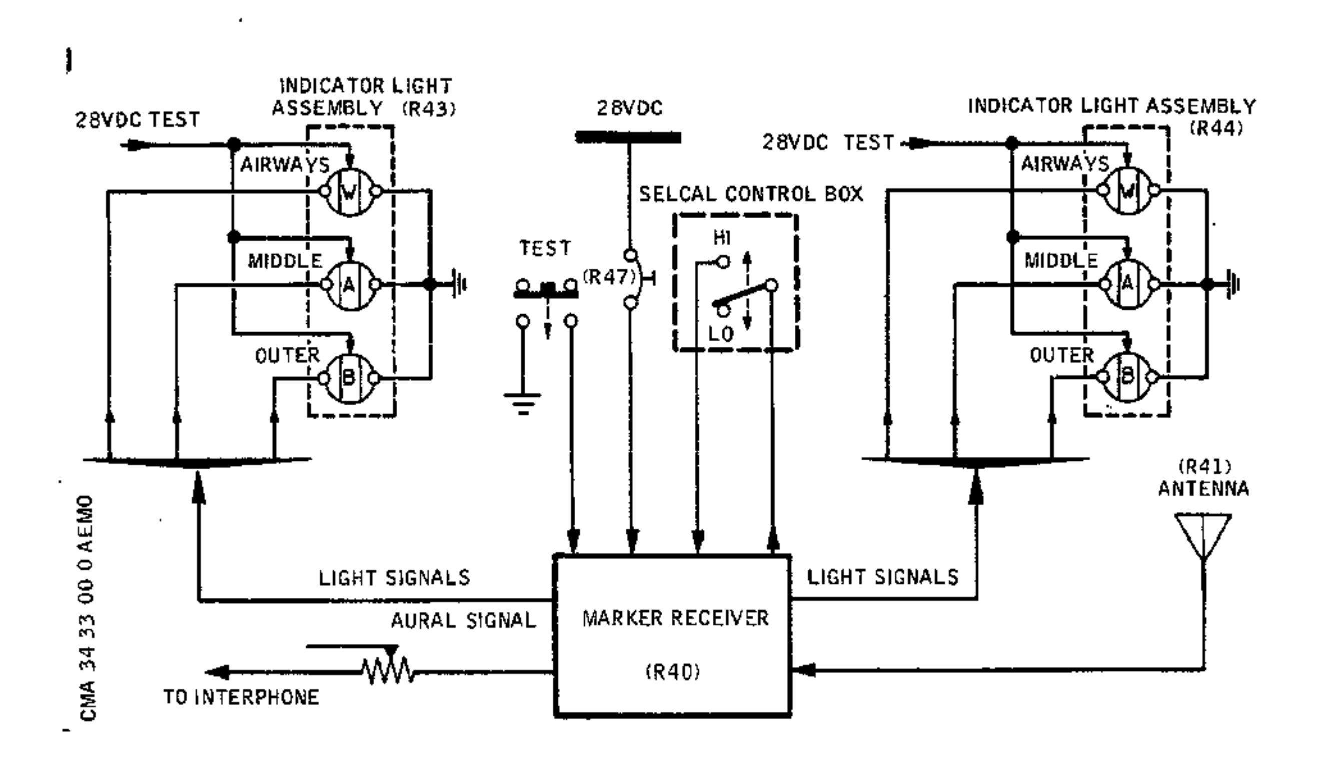
(1) Three indicator lights

(2) The interphone circuit, with potentiometer controlled audio frequency output.

The beacon signals are in the following form :

BEACON POSITION	INDICATOR LIGHT SIGNALS	AURAL SIGNALS
Outer beacon	Colour blue	400 Hz tone
Middle beacon	Colour amber	1300 Hz tone

BEACON POSITION	INDICATOR LIGHT SIGNALS	AURAL SIGNALS
Inner beacon	Colour white	3000 Hz tone



Marker : Operation Block Diagram
Figure 003

Marker receiver sensitivity is controlled by HI-LO switch on the selcal control box.

B. Tests

(1) Indicator lights : are tested by pressing each indicator to check correct operation.

(2) Self-test : performed automatically by pressing test push-button on the captain instrument panel (panel 2-211).

MARKER BEACON SYSTEM - TROUBLE SHOOTING

CAUTION : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified.
The defect can be isolated with the aid of trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.
Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101).
The table provides information, including component location, required for rectification.
All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Prepare

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Headset, 600 Ohms	Aircraft Equipment
Marker Ground Test Unit	
VHF SWR Meter	

B. Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

C. Switch on electronics rack ventilation system (Ref. 21-21-00).

D. Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NO.1 INPH SUP	1-213	R 89	K19
NO.2 INPH SUP	3-213	R 90	H 2
MARKER SUP		R 47	H 6

E. On Captain jack panel on LH side console, panel 1-211, connect headset to HEADSET jack.

F. On centre console 7-211 :

(1) On Captain audio selector panel, select MARKER push-button and adjust its integral potentiometer to mid-range.

(2) On SELCAL control box, place MARKER HI-LO switch in LO position.

G. On LH electronics rack, remove panel 215ES to permit access to shelf 3-215.

3. Trouble Shooting

```
****************************************************
* On Captain and First Officer instrument panels     *
* 2-211 and 2-212, press successively each OUTER,    *
* MIDDLE and AIRWAY indicator light. They illuminate *
* Release indicator lights after check of correct    *
* operation. Lights extinguish. IF                   *
****************************************************
    ||   |      ----------------------------------------------
    ||   |     | No indicator lights illuminate.              |
    OK   NOT OK----| Ref. Chart 101.                          |
    ||   |      ----------------------------------------------
    ||   |
    ||   |      ----------------------------------------------
    ||   |     | One indicator light does not illuminate.     |
    OK   NOT OK----| Trip circuit breaker [1]. Remove cap from |
    ||   |     | indicator light and replace faulty bulb.     |
    ||   |      ----------------------------------------------
****************************************************
* On Captain instrument panel 2-211, press and hold  *
* TEST push-button [3] :                             *
* - On Captain and First Officer instrument panels   *
*   2-211 and 2-212, OUTER, MIDDLE and AIRWAY indic- *
```

```
*   ator lights illuminate successively.          *
* - Check simultaneously in headset that each indic- *
*   ator light illumination corresponds with 400,    *
*   1300 and 3000 Hz tones. IF                       *
******************************************************
    ||   |         ------------------------------------------------
    ||   |         | No illumination of indicator lights or aural  |
    OK   NOT OK----| tones.                                        |
    ||   |         | Ref. Chart 102.                               |
    ||   |         ------------------------------------------------
    ||   |
    ||   |         ------------------------------------------------
    ||   |         | Indicator lights illuminate but no aural tones.|
    OK   NOT OK----| Ref. Chart 103.                               |
    ||   |         ------------------------------------------------
    ||   |
    ||   |         ------------------------------------------------
    ||   |         | No illumination of one or more indicator lights|
    OK   NOT OK----| aural tones are correct.                      |
    ||             | Trip circuit breaker [1].                     |
    ||             | Replace marker beacon receiver [2].           |
    ||             ------------------------------------------------
```

```
*****************************************************
* Position and switch on marker ground test unit.   *
* Select successively on ground test unit AIRWAY,   *
* OUTER and MIDDLE functions.                       *
* Check at each selected function :                 *
* - On Captain and First Officer instrument panels  *
*   that corresponding indicator light illuminates. *
* - In headset, the aural tone corresponding to the *
*   indicator light is audible. IF                  *
*****************************************************
    ||   |        -----------------------------------------
    ||   |       | Lack of sensitivity                    |
    OK  NOT OK----| Ref. Chart 104.                        |
    ||            -----------------------------------------
*****************************************************
* On marker ground test unit, select a function,    *
* (AIRWAY, OUTER or MIDDLE) :                       *
* - On Captain and First Officer instrument panels  *
*   corresponding indicator light illuminates.      *
* - In headset aural tone corresponding to the ind- *
*   icator light is audible.                        *
* Centre console 9-211, on Selcal control box [4],  *
* place MARKER switch in HI position, aural tone    *
* volume increases. IF                              *
*****************************************************
    ||   |        -----------------------------------------
    OK  NOT OK----| No HI-LO switch action.                |
    ||            | Ref. Chart 105.                        |
    ||            -----------------------------------------
*****************************************************
* Marker beacon system is operational               *
*****************************************************
```

```
*************************************-----------------------------
* NO INDICATOR LIGHT ILLUMINATES.    *| GROUND EQUIPMENT REQUIRED |
*************************************|----------------------------|
                                     | DESCRIPTION       PART NO. |
                                     |----------------------------|
                                     | MULTIMETER                 |
                                     ------------------------------

*****************************************************
* Check 28VDC at output of circuit breaker [1].     *
*****************************************************
    |    |       ---------------------------------------------------
    |    |      | Trip circuit breaker [1].                         |
    NO   YES----| Replace marker beacon receiver [2].               |
    |            ---------------------------------------------------
   --------------------------------------------------
-----------------------------------------------------
| Replace circuit breaker [1].                      |
-----------------------------------------------------
```

Chart 101

```
**************************************
* INDICATOR LIGHTS DO NOT ILLUMINATE,*
* NO AURAL TONES.                    *
**************************************

****************************************************
* Shelf 3-215, on marker beacon receiver [2] press  *
* and hold TEST push-button on front panel.         *
* On Captain and First Officer instrument panels    *
* the indicator lights illuminate successively,     *
* accompanied by an aural tone corresponding to     *
* illumination of each indicator light.             *
****************************************************
     |    |
     |    |     ---------------------------------------------------
     |    |     | Trip circuit breaker [1].                        |
     NO   YES-----| Replace test push-button [3].                  |
     |          ---------------------------------------------------
----------------------------------------------------
| Trip circuit breaker [1].                         |
| Replace marker beacon receiver [2].               |
----------------------------------------------------
```

Chart 102

```
**************************************
* INDICATOR LIGHTS ILLUMINATE BUT NO *
* AURAL TONES                        *
**************************************

******************************************************
* Listen to marker beacon aural signals at another   *
* crew station.                                      *
******************************************************
     |    |
     |    |      -------------------------------------------------
     |    |      | Replace faulty audio selector panel.          |
     NO   YES----| (Ref. 23-41-00, Trouble Shooting)             |
     |           -------------------------------------------------
     |
------------------------------------------------------
| Trip circuit breaker [1].                          |
| Replace marker beacon receiver [2]. IF             |
------------------------------------------------------
          |
          |      -------------------------------------------------
          |      | Aural signal still absent, ref. interphone sys-|
          NOT OK--| tem (Ref. 23-41-00, Trouble Shooting)         |
                 -------------------------------------------------
```

Chart 103

LACK OF SENSITIVITY

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
VHF SWR METER	

On shelf 3-215, disconnect antenna coaxial cable from its connector R48A.
Connect SWR meter to antenna coaxial cable.
Adjust SWR meter to 75 MHz and check that SWR value is maximum 5.

YES → Trip circuit breaker [1].
Replace marker beacon receiver [2].

NO → Remove marker antenna [5].
Adjust the two tuning capacitors after removal of protective plugs.
Temporarily install antenna and again measure SWR
If SWR is still not within tolerance, repeat adjustment of tuning capacitors until correct value is obtained.

NO → SWR out of tolerance, trip circuit breaker [1]
Replace marker antenna [5].

Chart 104

```
***************************************
* NO HI-LO SWITCH ACTION              *
***************************************

********************************************************
* Trip circuit breaker [1].                            *
* Replace marker beacon receiver [2].                  *
********************************************************
          |
          |
          |      ---------------------------------------------------
          |      | Trip Selcal [6], [7] and marker [1] circuit     |
          NO-----| breakers.                                       |
                 | Replace Selcal control box [4].                 |
                 ---------------------------------------------------
```

Chart 105

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] Circuit breaker 28VDC		3-213	R47	Map Ref. H 6	24-50-00 R/I	34-33-11
[2] Marker Beacon Receiver		3-215	R40	LH Elec-tronics rack	34-33-12 R/I	34-33-11
[3] TEST push-button		2-211	R45	Flight Compart-ment	34-33-21	34-33-11
[4]Selcal Control Box		7-211	R135 or R231	Flight Compart-ment	23-00-00 R/I	34-33-11
[5] Marker Antenna	34A and 35	131	R49	Under Fuselage	34-33-11 R/I	34-33-11
[6] Circuit Breaker 28VDC		15-215	R117	Map Ref. F18	24-50-00 R/I	23-22-11
[7] Circuit Breaker 28VDC		15-216	R118	Map Ref. E13	24-50-00 R/I	23-22-11

R Component Identification
Table 101

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
600 ohms Headset Provided With Test Set TE2037000	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing)

(2) Make certain that the following circuit breakers are reset :

(a)

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No.1 INPH SUP	1-213	R 89	K19
No.2 INPH SUP	3-213	R 90	H 2
MARKER SUP		R 47	H 6

(3) On captain jack-box on LH side console (1-211) connect headset to HEADSET jack.

(4) On captain audio selector panel on centre console (7-211) select reception on MARKER push-button and turn its incorporated potentiometer towards maximum.

(5) On selcal control box on centre console (7-211) place switch MARKER HI-LO in LO position.

(6) Switch on electronics rack ventilation system (Ref. 21-21-00).

C. Tests

(1) Indicator light check

(a) On captain instrument panel (2-211), press successively each indicator light (indicator light assembly R43) :

- Blue OUTER
- Amber MIDDLE
- White AIRWAY

(a1) Each indicator light illuminates when pressed and extinguishes when released.

(a2) Check when indicator lights are illuminated that their intensity is reduced when dimmer caps are turned.

(b) On co-pilot instrument panel (2-212), carry out on indicator light assembly (R44) a similar check to that in 1 C (1) (a).

(2) Receiver check in Self-Test Mode

(a) On captain instrument panel (2-211), press and hold TEST push-button (R45) located below indicator light assembly (R43).

(b) In headset and on captain (2-211) and co-pilot (2-212) instrument panels make certain that :

(b1) 400 Hz tone is audible and blue OUTER indicator lights illuminate. A moment later tone ceases and blue indicator lights extinguish.

(b2) 1300 Hz tone is audible and amber MIDDLE indicator lights illuminate, a moment later tone ceases and amber indicator lights extinguish.

(b3) 3000 Hz tone is audible and white indicator lights AIRWAY illuminate, aural tone and indicator lights remain in this configuration.

(c) Release TEST push-button (R45) :

(c1) 3000 Hz tone is no longer audible in headset.

(c2) White indicator lights AIRWAY (indicator light assemblies R43 and R44) extinguish.

D. Close-Up

(1) On captain audio selector panel on centre console (7-211), switch off marker reception by means of push-button MARKER and place its potentiometer in mid-position.

(2) On captain jack-box on LH side console (1-211), disconnect headset from HEADSET jack.

(3) Switch of electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
600 ohms Headset Provided With Test Set TE203700	
MARKER Ground Test Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing)

(2) Make certain that the following circuit breakers are reset :

(a)

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No.1 INPH SUP	1-213	R 89	K19
No.2 INPH SUP	3-213	R 90	H 2
MARKER SUP		R 47	H 6

(3) On captain jack-box on LH side console (1-211), connect headset to HEADSET jack.

(4) On captain audio selector panel, centre console (7-211), select reception on push-button MARKER and turn its incorporated potentiometer towards maximum.

(5) On selcal control box, centre console (7-211), place switch MARKER HI-LO in LO position.

(6) Switch on electronics rack ventilation system (Ref. 21-21-00).

C. Tests

(1) Indicator light check

(a) Repeat procedure from operational test, ref. paragraph 1-C-(1).

(2) Receiver check in Self-Test mode

(a) Repeat procedure from operational test, ref. paragraph 1-C-(2).

(3) Test of MARKER SYSTEM using ground test unit

(a) Position and switch on ground test unit

(b) On selcal control box on centre console (7-211), make certain that MARKER HI-LO switch is in LO position.

(c) On ground test unit, select OUTER function (frequency 400 Hz) and check that :

- Blue OUTER Indicator lights on Captain and First Officer' instrument panel illuminate
- 400 Hz aural tone can be heard in headset

(d) On Selcal control box place MARKER HI-LO switch in HI position and make certain that :

- Level of 400 Hz aural signal is higher

(e) On Selcal control box place MARKER HI-LO switch in LO position.

(f) On ground test unit, select MIDDLE function (frequency 1300 Hz) and check that :

- Amber MIDDLE indicator lights on Captain and First Officer instrument panels illuminate
- 1300 Hz aural tone can be heard in headset

(g) On ground test unit, select AIRWAY function (frequency 3000 Hz) and check that :

- White AIRWAY indicator lights on Captain and First Officer instrument panel illuminate
- 3000 Hz aural tone can be heard in headset

(h) On Captain audio selector panel :

(h1) Turn potentiometer incorporated in MARKER push-button and make certain that its action is progressive and does not cause crackling.

(h2) Switch off marker reception by means of MARKER push-button, aural tone is no longer audible. Place incorporated potentiometer in mid-position.

(i) Repeat operations 2-C-(3)-(g) and 2-C-(3)-(h) successively for each audio selector panel, checking reception on the respective jack panel :

- First Officer audio selector panel on centre console (7-211) with First Officer jack panel on RH side console (1-212)
- Flight Engineer audio selector panel and jack panel at Flight Engineer station on panel 8-214
- 1st observer audio selector panel and jack panel on panel 7-213

NOTE : Disconnect headset from Captain jack panel and connect to jack panel in use.

D. Close-Up

(1) Disconnect headset from HEADSET jack on last jack panel.

(2) On last audio selector panel used make certain that MARKER reception push-button is in off position and place incorporated potentiometer in mid-position.

(3) Switch off and remove ground test unit.

(4) Switch off electronics rack ventilation system (Ref. 21-21-00).

(5) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

3. System Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
600 ohms Headset Provided With Test Set	TE2037000
MARKER Ground Test Unit	
VHF S.W.R. Meter (FERISOL T0201 or equivalent)	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing)

(2) Make certain that the following circuit breakers are reset :

(a)

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No.1 INPH SUP	1-213	R 89	K19
No.2 INPH SUP	3-213	R 90	H 2
MARKER SUP		R 47	H 6

(3) On captain jack box on LH side console (1-211), connect headset to HEADSET jack.

(4) On captain audio selector panel, centre console (7-211), select reception on push-button MARKER and turn its associated potentiometer towards maximum.

(5) On selcal control box on centre console (7-211), place switch MARKER HI-LO in LO position.

(6) Switch on electronics rack ventilation system (Ref. 21-21-00).

C. Tests

(1) Indicator light check :

- Refer to operational test in 1 C (1).

(2) Receiver check in self-test mode

- Refer to operational test in 1 C (2).

(3) S.W.R. check

(a) Disconnect antenna coaxial cable from connector R48A on shelf 3-215.

(b) Connect S.W.R. meter to antenna coaxial cable.

(c) Using S.W.R. meter adjusted to frequency of 75 MHz, measure and note S.W.R. value which must be a maximum of 5.

(d) If S.W.R. value is :

- 5 or less, disconnect S.W.R. meter and connect antenna coaxial cable to connector R48A, shelf 3-215.
- Greater than 5, carry out adjustment of antenna tuning capacitors (Ref. 34-33-11, Removal/Installation).

(4) Test of MARKER system using ground test unit.

- Refer to functional test in 2 C (3).

D. Close-Up

- Refer to close-up of functional test in 2 D.

ANTENNA - REMOVAL/INSTALLATION

1. General

Removal for exchange or adjustment of tuning capacitors follo-
R wing an SWR check.

2. Antenna

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform, Height 3.14 m (10 ft. 3 in.)	
Blanking Caps for Electrical Connectors	
Safety Clips	
Sealing Compound (Ref. 20-30-00, No.313)	
R VHF SWR Meter (FERISOL T0201 or equivalent)	

B. Prepare

(1) On panel 3-213 trip, safety and tag circuit breaker MARKER SUP (R47), map ref H6.

(2) Position access platform in zone 131 (between frames 34A and 35).

C. Remove (Ref. Fig. 401)

CAUTION : HANDLE EQUIPMENT WITH CARE.

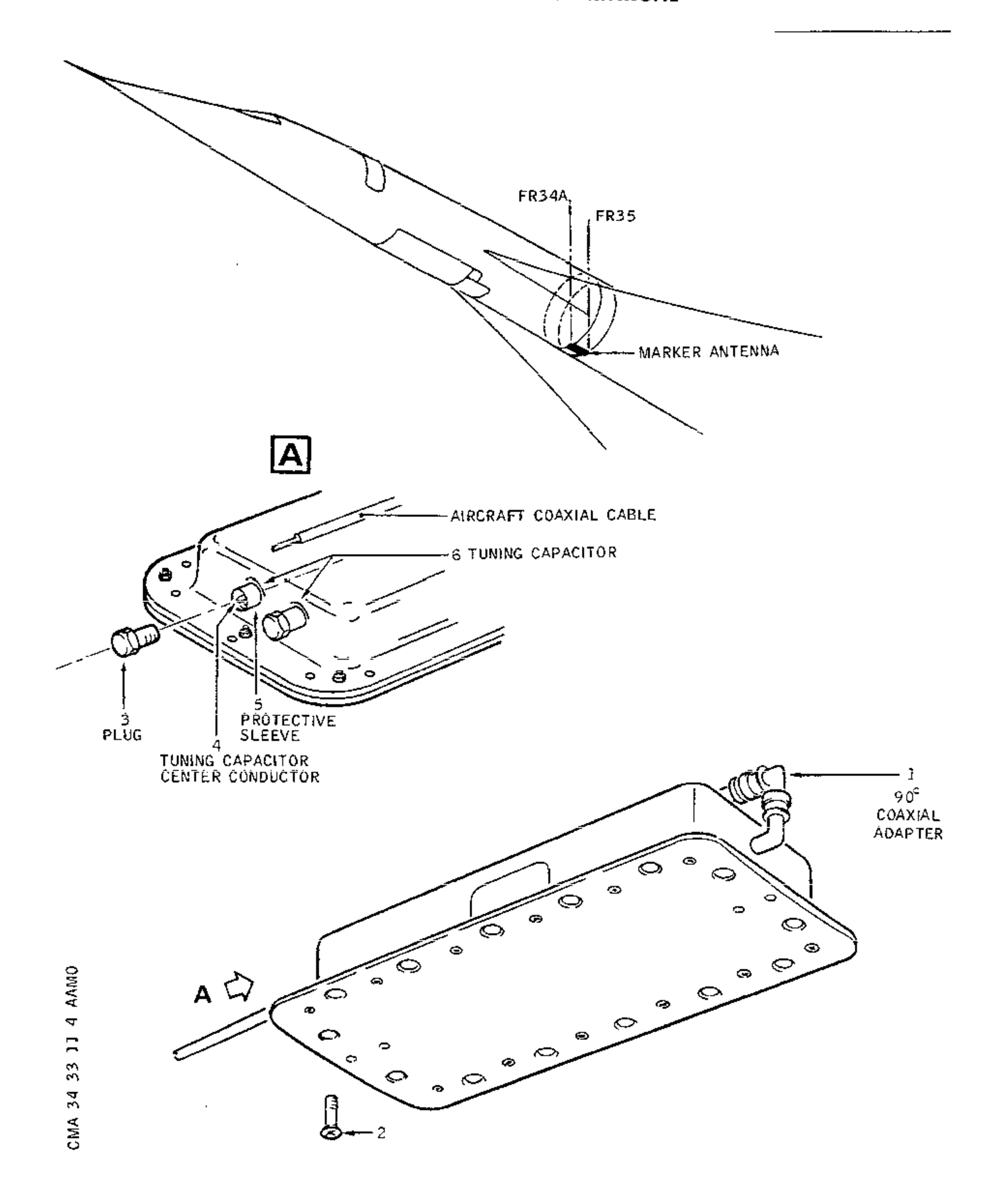
R (1) Remove screws (2), remove antenna from housing.

R (2) Disconnect (90°) coaxial adapter (1).

(3) Blank off connectors.

D. Preparation of replacement component

(1) Make certain that antenna is in good external condi-



R

Antenna : Removal/Installation
Figure 401

tion, particularly that connector has no trace of corrosion.

(2) Make certain that antenna housing on aircraft is clean.

R E. SWR check

(1) Remove connector blanking caps, connect (90°) coaxial
R adapter (1).

(2) Install antenna in housing, securing temporarily by 4
R screws (2).

R (3) Check SWR (Ref. 34-33-00, Adjustment/Test).

R (4) If SWR is :

- Correct, install antenna
- Incorrect, carry out adjustment of tuning capacitors.

F. Tuning capacitor adjustment

(1) Remove antenna without removing blanking caps.

R (2) Remove plugs (3) from protective capsules (5) and ad-
R just the 2 tuning capacitors (6).

(3) Install antenna, securing temporarily.

R (4) Measure SWR (Ref. para. 2.E.(3)).

R (5) If SWR is still not within tolerance, repeat operations 2.F.(2), 2.F.(3) and 2.F.(4) until specified value is obtained.

(6) When antenna electrical adjustment is completed, lock
R capacitor center conductors (4) with product No.313 and
R cover end of capsules (5) with this product to ensure
R sealing. Replace and tighten plugs (3).

(7) Install antenna.

G. Install

R (1) Install all screws (2), gently tighten.

H. Tests

(1) On panel 3-213 remove safety clips and tags and reset circuit breaker MARKER SUP (R47) (position H6).

(2) Repeat paragraph 2A, Equipment and Materials, Functional test (Ref. 34-33-00, Adjustment/Test).

(3) Repeat paragraph 2B, Prepare, Functional Test (Ref. 34-33-00, Adjustment/Test).

(4) Position and switch on ground test unit.

(5) On ground test unit, select OUTER function (frequency 400 Hz) and check that :
- blue OUTER indicator lights illuminate on Captain and First Officer instrument panels
- 400 Hz tone is audible in headset

(6) On ground test unit, select MIDDLE function (frequency 1300 Hz) and check that :
- amber MIDDLE indicator lights illuminate on Captain and First Officer instrument panels
- 1300 Hz tone is audible in headset

(7) On the ground test unit, select AIRWAY function (frequency 3000 Hz) and check that :
- white AIRWAY indicator lights illuminate on Captain and First Officer instrument panels
- 3000 Hz tone is audible in headset

I. Close-Up

(1) Switch off and remove ground test unit.

(2) On Captain jack panel, disconnect headset from HEADSET jack.

(3) On Captain audio selector panel, release MARKER reception selection push-button.

(4) Switch off electronics rack ventilation system (Ref. 21-21-00).

(5) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(6) Remove access platform from zone 131.

MARKER BEACON RECEIVER - REMOVAL/INSTALLATION

1. General

The Marker Beacon receiver R40 is installed in LH electronics rack, on shelf 3-215.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	
Blanking plates for Ventilation Outlets	

B. Prepare

(1) Trip, safety and tag circuit breaker MARKER SUP (R47), Panel 3-213, Map Ref. H6.

(2) On LH electronics rack, remove panel 215ES providing access to shelf 3-215.

C. Remove

Refer to 34-00-00, Removal/Installation, paragraph 2.D.

D. Preparation of Replacement Component

Refer to 34-00-00, Removal/Installation paragraph 2.E.

E. Install

Refer to 34-00-00, Removal/Installation, paragraph 2.F.

F. Test

(1) Remove safety clip and tag, and reset circuit breaker previously tripped in paragraph 2.B.(1)

(2) Carry out an operational test of marker beacon receiver (Ref. 34-33-12, Adjustment/Test).

G. Close-Up

(1) On LH electronics rack, install panel 215ES.

MARKER BEACON RECEIVER ADJUSTMENT/TEST

1. General

A check of the marker beacon receiver shall be carried out after removal/installation or replacement of the receiver.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
600 Ohm Headset	Aircraft Equipment

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Make certain that the following circuit breakers are reset :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No.1 INPH SUP	1-213	R 89	K19
No.2 INPH SUP	3-213	R 90	H 2

(3) On Captain jack-box, on LH side console (1-211) connect headset to HEADSET jack

(4) On Captain audio selector panel on centre console (7-211) select reception on MARKER pushbutton and turn integral potentiometer to mid position.

(5) Operate electronics rack ventilation (Ref, 21-21-00)

C. Test

(1) On Captain instrument panel 2-211, press and hold TEST pushbutton beneath MARKER indicator lights group.

(2) In headset and on Captain and First Officer instrument panels make certain that :

(a) 400 Hz tone is audible and blue OUTER indicator lights illuminate. A moment later tone stops and blue indicator lights extinguish.

(b) 1300 Hz tone is audible and amber MIDDLE indicator lights illuminate. A moment later tone stops and amber indicator lights extinguish.

(c) 300 Hz tone is audible and white AIRWAY indicator lights illuminate. The tone and indicator lights remain in this configuration.

(3) Release TEST pushbutton

(a) 300 Hz tone stops and white indicator lights extinguish.

D. Close-Up

(1) On Captain audio selector panel switch off reception by MARKER pushbutton

(2) On Captain jack-box disconnect headset from HEADSET jack.

(3) Shut down electronics rack ventilation, Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

INDICATOR LIGHT ASSEMBLY - REMOVAL/INSTALLATION

1. General

Two indicator light assemblies (R44) and (R43) are installed on First Officer instrument panel 2-212/4 and Captain instrument panel 2-211/5 respectively.
A TEST push-button (R45) is installed on Captain indicator light assembly :
In this topic the following subjects are described :
- Relamping one or more indicator lights
- Removal/installation of indicator light assemblies from instrument panels.
- Replacement of TEST push-button.

2. Relamping

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Lamp Filament (Min-Bayonet T-3 1/4 6.3 V, 0.15 A)	

B. Prepare

(1) Trip, safety and tag circuit breaker MARKER SUP (R47), panel 3-213, map ref. H6.

C. Remove (Ref. Fig. 401)

(1) On Captain or First Officer indicator light assembly (1), pull and remove cap (5).

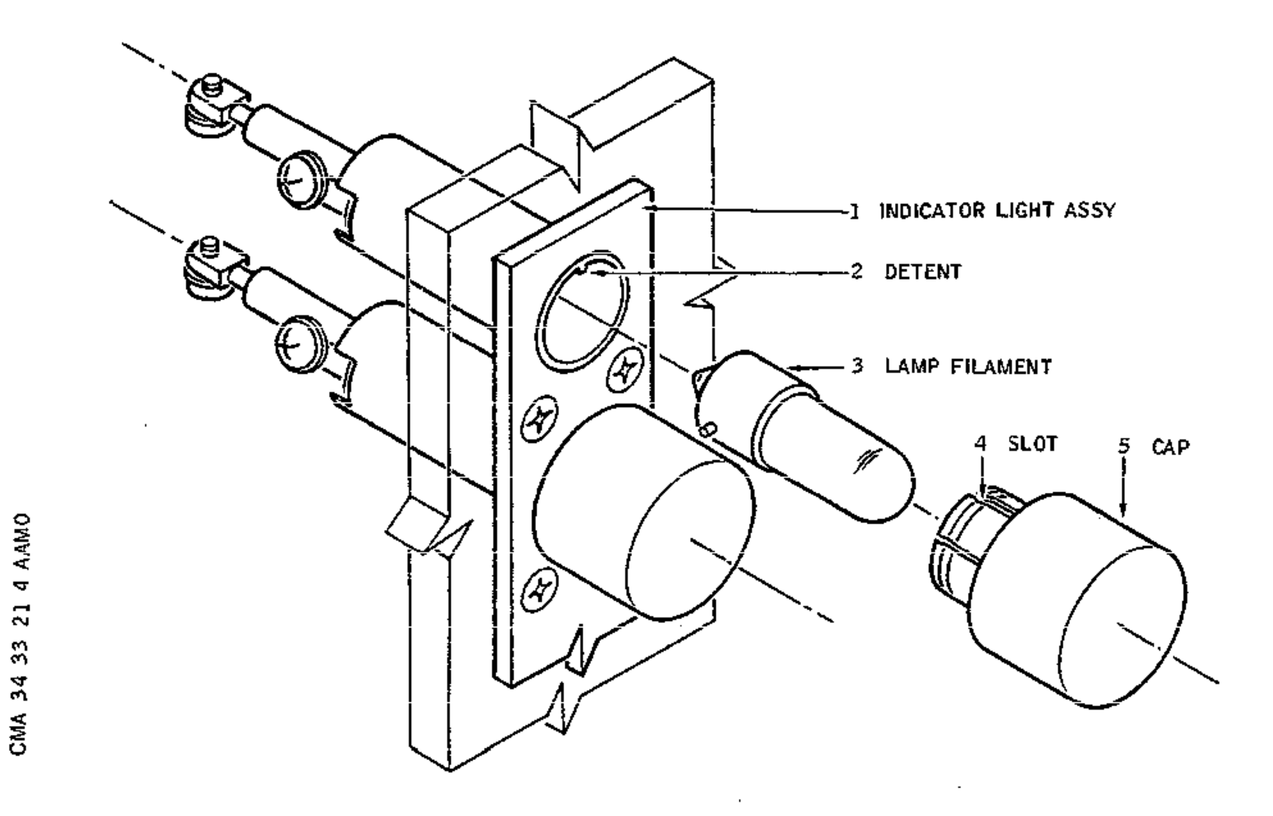
(2) Release and remove faulty lamp filament (3).

D. Install (Ref. Fig. 401)

(1) Position and latch new lamp filament (3) in its socket.

(2) Position cap (5) in its seating, engaging detent (2) in slot (4).

(3) Push cap (5) fully home against indicator light assembly (1).



Relamping
Figure 401

E. Close-Up

(1) Reset circuit breaker tripped in paragraph 2.B (1).

(2) Carry out an indicator light test (Ref. 34-33-21, Adjustment/Test).

3. Removal/Installation of Indicator Light Assembly

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	

B. Prepare

(1) For Captain indicator light assembly (R43).

(a) Trip, safety and tag circuit breaker MARKER SUP (R47), panel 3-213, map ref. H6.

(b) Remove the two mounting panel attachment screws and withdraw indicator light assembly and mounting panel.

(c) Disconnect aircraft connector from indicator light assembly connector.

(d) Cap connectors.

(2) For First Officer indicator light assembly (R44)

(a) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS. 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS 1 SW SUP		1F 134	F14
MARKER SUP	3-213	R 47	H 6
COMPASS COUPLER SYS 2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C21
ATT/INS 2ND PLT SW SUP		2F 13	D21
DEV 1 & 2 2ND PLT SW SUP		2R 38	F21

(b) Remove the four attachment screws from mounting panel for navigation switching switches and indicator light assembly.

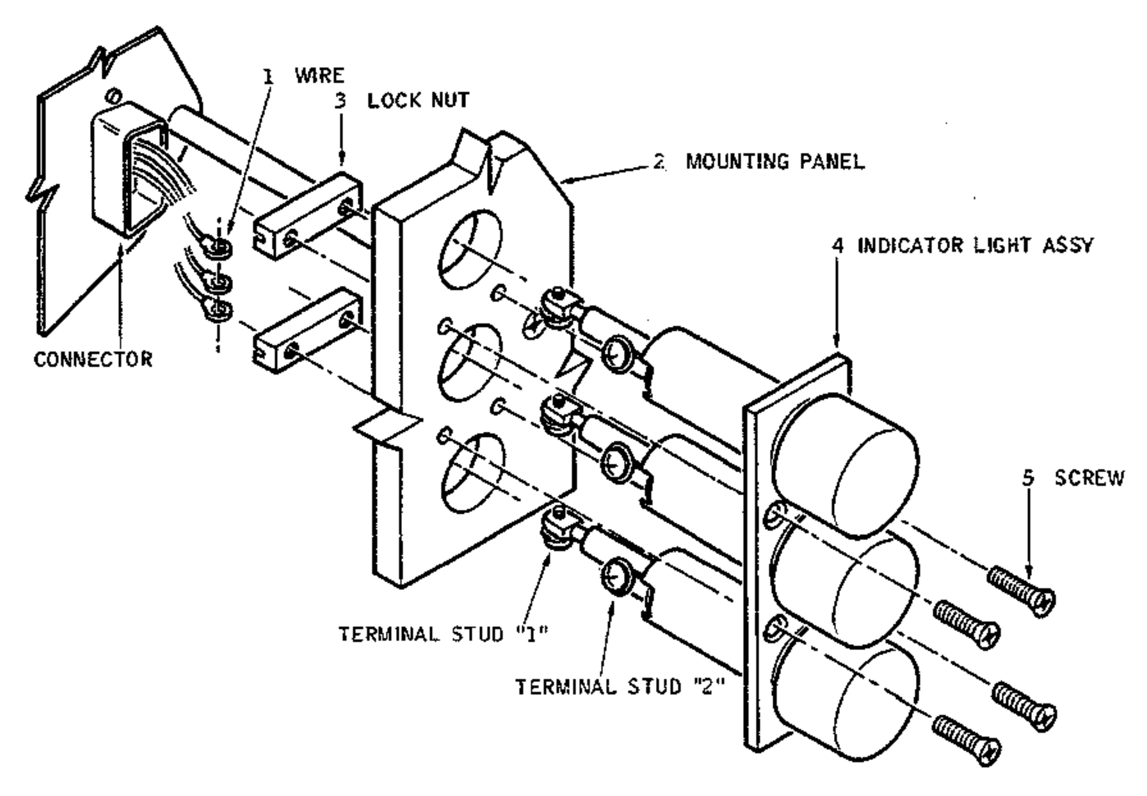
(c) Disconnect the two aircraft connectors from mounting panel connectors.

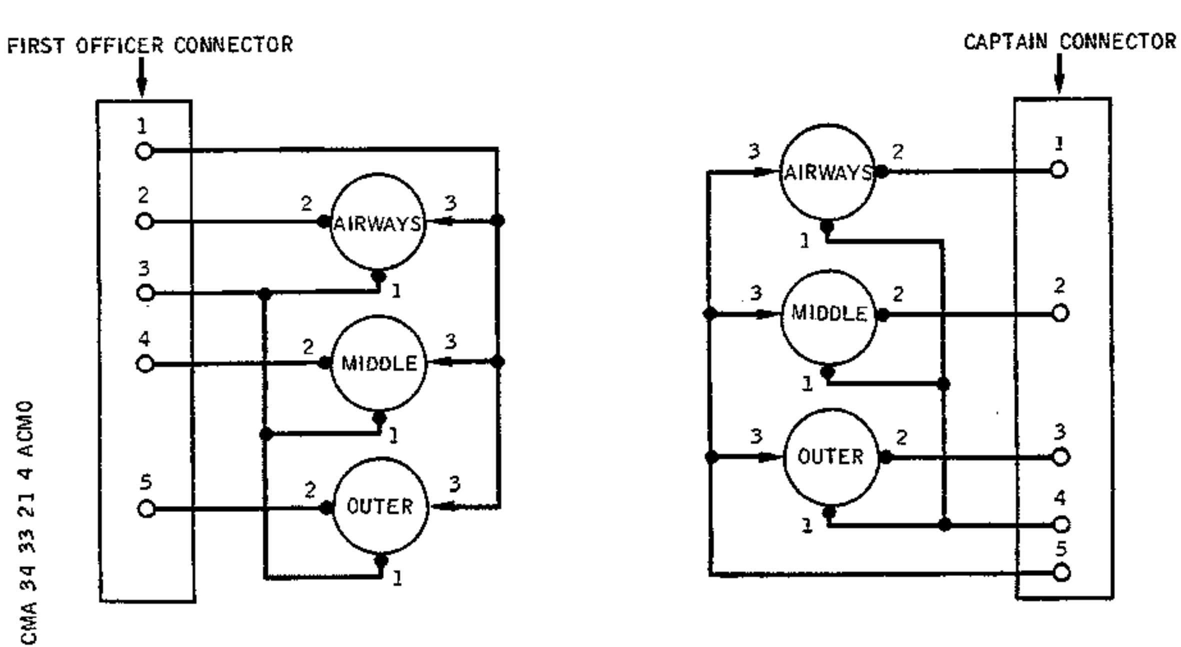
(d) Cap all connectors

C. Remove (Ref. Fig. 402)

(1) On First Officer indicator light assembly (R44) (4), disconnect wires (1) connecting.

(a) On AIRWAYS indicator light.
- terminal stud 3 to pin 1 of connector and to terminal 1 of MIDDLE indicator light.





Removal/Installation of Indicator Light Assembly
Figure 402

- terminal stud 2 to pin 2 of connector.
- terminal stud 1 to pin 3 of connector and to terminal stud 3 of MIDDLE indicator light.

(b) On MIDDLE indicator light
- terminal stud 2 to pin 4 of connector.

(c) On OUTER indicator light
- terminal stud 2 to pin 4 of connector.
- terminal studs 1 and 3 to same terminal studs of MIDDLE indicator light.

(2) On Captain indicator light assembly (R43) (4), disconnect wires (1) connecting.

(a) On AIRWAYS indicator light
- terminal stud 2 to pin 4 of connector.
- terminal studs 1 and 3 to same terminal studs of MIDDLE indicator light.

(b) On MIDDLE indicator light
- terminal stud 2 to pin 2 of connector.

(c) On OUTER indicator light
- terminal stud 2 to pin 3 of connector.
- terminal stud 1 to pin 4 of connector and to terminal stud 1 of MIDDLE indicator light.
- terminal stud 3 to pin 5 of connector and to terminal stud 3 of MIDDLE indicator light.

(3) Remove the four screws (5) attaching indicator light assembly (4) to mounting panel (2) and retain the two locknuts (3).

(4) Withdraw indicator light assembly (4) from mounting panel (2).

D. Preparation of Replacement Component

(1) Visually check indicator light assembly for correct condition. Make certain that there are no traces of corrosion on terminal studs of each indicator light.

(2) Press cap of each indicator light and make certain that terminal stud 1 (press to test) travels a maximum of 1.27 mm (0.05 in.).

(3) On terminal studs 1 and 3 of MIDDLE indicator light, connect wires for connections with the other two indicator lights.

(4) Make certain that pins of indicator light assembly connector are intact, without traces of corrosion.

(5) Check that wires for connections from connector pins to indicator light terminal studs are in correct condition and are properly attached.

E. Install (Ref. Fig. 402)

(1) Engage indicator light assembly (4) in mounting panel (2).

(2) Position the four screws (5), install in the two locknuts (3) and tighten.

(3) On Captain indicator light assembly (R43) (4), connect wires (1) connecting.

(a) On OUTER indicator light
- terminal stud 1 to terminal stud 1 of MIDDLE indicator light and to pin 4 of connector.
- terminal stud 3 to terminal stud 3 of MIDDLE indicator light and to pin 5 of connector.
- terminal stud 2 to pin 3 of connector.

(b) On MIDDLE indicator light
- terminal stud 2 to pin 2 of connector.

(c) On AIRWAYS indicator light
- terminal stud 2 to pin 1 of connector
- terminal stud 1 to terminal stud 1 of MIDDLE indicator light.
- terminal stud 3 to terminal stud 3 of MIDDLE indicator light.

(4) On First Officer indicator light assembly (R44) (4) connect wires (1) connecting.

(a) On OUTER indicator light
- terminal stud 2 to pin 5 of connector.
- terminal stud 3 to terminal stud 3 of MIDDLE indicator light.
- terminal stud 1 to terminal stud 1 of MIDDLE indicator light.

(b) On MIDDLE indicator light
- terminal stud 2 to pin 4 of connector.

(c) On AIRWAYS indicator light
- terminal stud 2 to pin 2 of connector.
- terminal stud 3 to terminal stud 3 of MIDDLE

indicator light and to pin 1 of connector.
- terminal stud 1 to terminal stud 1 of MIDDLE indicator light and to pin 3 of connector.

F. Close-Up

(1) For Captain indicator light assembly (R43)

(a) Remove blanking caps from connectors.

(b) Connect aircraft connector to indicator light assembly connector.

(c) Install indicator light assembly and mounting panel in instrument panel seating, install and tighten the two attachment screws.

(d) Reset circuit breaker tripped in paragraph 3.B (1) (a).

(2) For First Officer indicator light assembly (R44)

(a) Remove blanking caps from all connectors.

(b) Connect the two aircraft connectors to mounting panel connectors (for navigation switching switches and indicator light assembly).

(c) Install indicator light assembly and mounting panel in instrument panel seating, install and tighten the four attachment screws.

(d) Reset circuit breakers tripped in paragraph 2.B. (2) (a).

(3) Carry out an indicator light test (Ref. 34-33-21, Adjustment/Test).

4. Replacement of TEST Push-Button

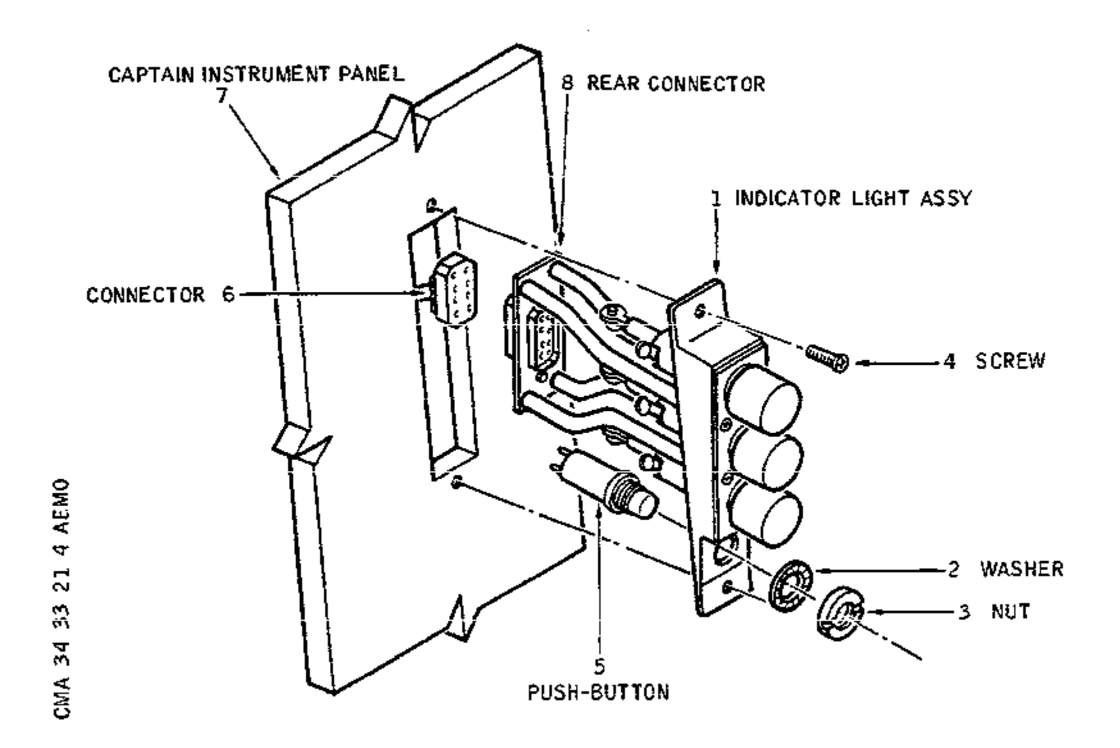
A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	

B. Prepare

(1) Trip, safety and tag circuit breaker MARKER SUP (R47), panel 3-213, map ref. H6.

C. Remove (Ref. Fig. 403)



Replacement of TEST Push-Button
Figure 403

(1) On Captain instrument panel (7), remove the two attachment screws (4) from indicator light assembly (1) mounting panel and withdraw indicator light assembly on mounting panel.

(2) Disconnect aircraft connector (6) from indicator light assembly connector (8).

(3) Cap connectors (6) and (8).

(4) Disconnect wires from TEST push-button (5).

(5) Loosen and remove nut (3) and washer (2).

(6) Withdraw TEST push-button from rear of indicator light assembly (1) mounting panel.

D. Preparation of Replacement Component

(1) Make certain that TEST push-button is in correct condition and that there are no traces of corrosion on contacts.

E. Install (Ref. Fig. 403)

(1) Insert TEST push-button (5) through rear of indicator light assembly (1) mounting panel.

(2) Install washer (2) and nut (3). Tighten nut.

(3) Connect wires to TEST push-button (5).

(4) Remove blanking caps from connectors (6) and (8).

(5) Connect aircraft connector (6) to indicator light assembly connector (8).

(6) Install indicator light assembly and mounting panel in seating in Captain instrument panel (7). Install and tighten the two attachment screws (4).

F. Close-Up

(1) Reset circuit breaker tripped in paragraph 4.B (1).

(2) Carry out an indicator light assembly test (Ref. 34-33-21, Adjustment/Test).

INDICATOR LIGHT ASSEMBLY - ADJUSTMENT/TEST

1. General

Test of indicator light assembly (s) is made up of two distinct parts which can be carried out seperately, depending on the work carried out.

A. Indicator light test following.

(1) Relamping.

(2) Removal/installation of indicator light assembly.

B. Indicator light assembly test from marker beacon receiver following.

(1) Replacement of TEST push-button.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

C. Indicator Light Test

(1) On Captain instrument panel 2-211 or First Officer instrument panel 2-212, press each indicator light in succession
- blue OUTER, amber MIDDLE and white AIRWAYS.
Check that

(a) Each indicator light illuminates when pressed.

(b) Holding indicator light pressed, brightness varies when cap is turned in one direction then the other.

(c) When indicator light is released it extinguishes.

D. Indicator light Assembly Test from Marker Beacon Receiver

(1) On Captain instrument panel 2-211, press and hold TEST push-button and check on Captain and First Officer instrument panels that the following sequence occurs.

(a) Blue OUTER indicator lights illuminate briefly then extinguish.

(b) Amber MIDDLE indicator lights illuminate briefly then extinguish.

(c) White AIRWAYS indicator lights illuminate briefly and remain illuminated.

(2) Release TEST push-button

(a) White AIRWAYS indicator lights extinguish.

E. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

END OF THIS SECTION

NEXT

INSTRUMENT LANDING SYSTEM (I.L.S.) - DESCRIPTION AND OPERATION

1. General

The ILS (Instrument Landing System) is intended to supply vertical and horizontal guidance information to the pilot during instrument landing procedure. In addition, the system supplies guidance and warning information to the AFCS (Automatic Flight Control System) during automatic landing procedure - LAND mode - also the AFCS is able to integrate this information in GLIDE mode without the automatic landing capability or in VOR/LOCALIZER cruise mode.

2. System Components (Ref. Fig. 001)

The ILS system comprises :

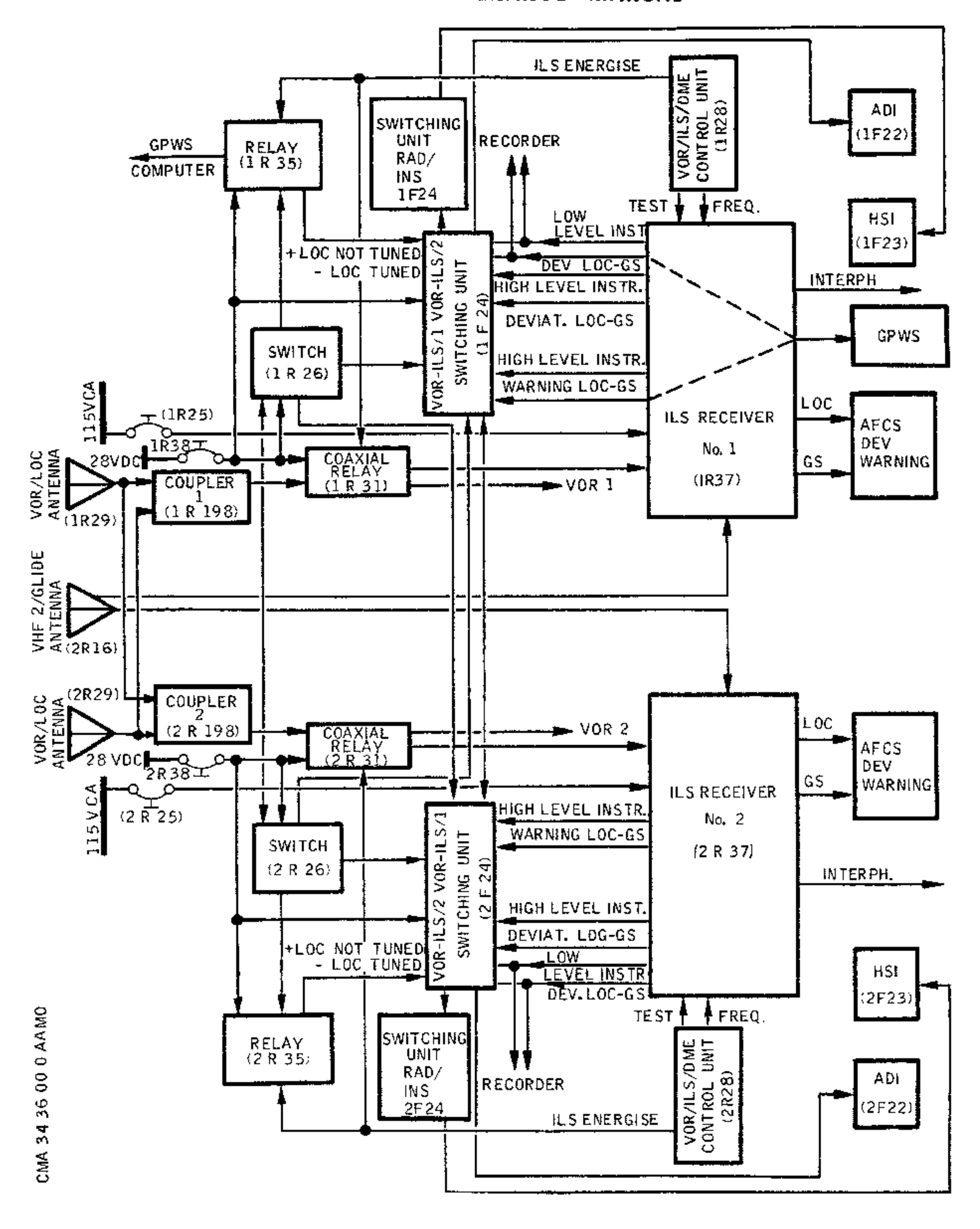
- 2 ILS receivers
- 2 VOR-ILS-DME control boxes
- 1 VOR ILS 1/VOR ILS 2 selector switch
- 1 VOR ILS 2/VOR ILS 1 selector switch
- 1 VHF 2/GLIDE antenna, common to the two assemblies
- 2 VOR/LOC antennas
- 2 VOR/LOC antenna coaxial relays
- 2 antenna couplers
- 2 HSI indicators
- 2 ADI indicators

NOTE : These multiple function indicators are not specifically part of the ILS system, and form also part of other systems.

3. Receiver-ILS - BENDIX RIA,32A (Ref. Fig. 002)

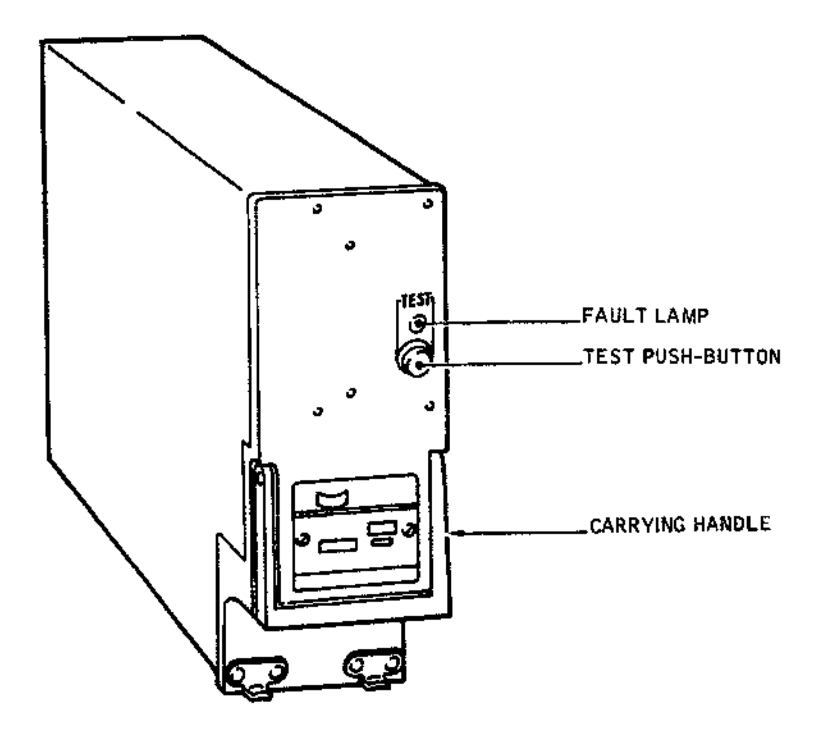
A. Description

The ILS receiver consists of two separate receivers installed in a single 3/8 ATR short case. Its weight is 14 lb. maximum (6.35 kg). A TEST push-button with incorporated fault indicator light is mounted on the front panel. The connector mounted on the lower part of the rear panel makes the electrical interconnections with the aircraft system. The connector mounted on the upper part is used for connection of automatic test equipment. The LOCALIZER receiver covers the VHF band from 108 to 111.95 MHz in 40 channels.
The GLIDESLOPE receiver covers the VHF band 329.15 to 335 MHz in 40 channels. They supply both deviation and warning outputs to the various devices and also an audio output. The receivers are physically and electrically separate but



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ILS : System Block Diagram
Figure 001



CMA 34 36 00 0 ACMO

ILS Receiver : Front View
Figure 002

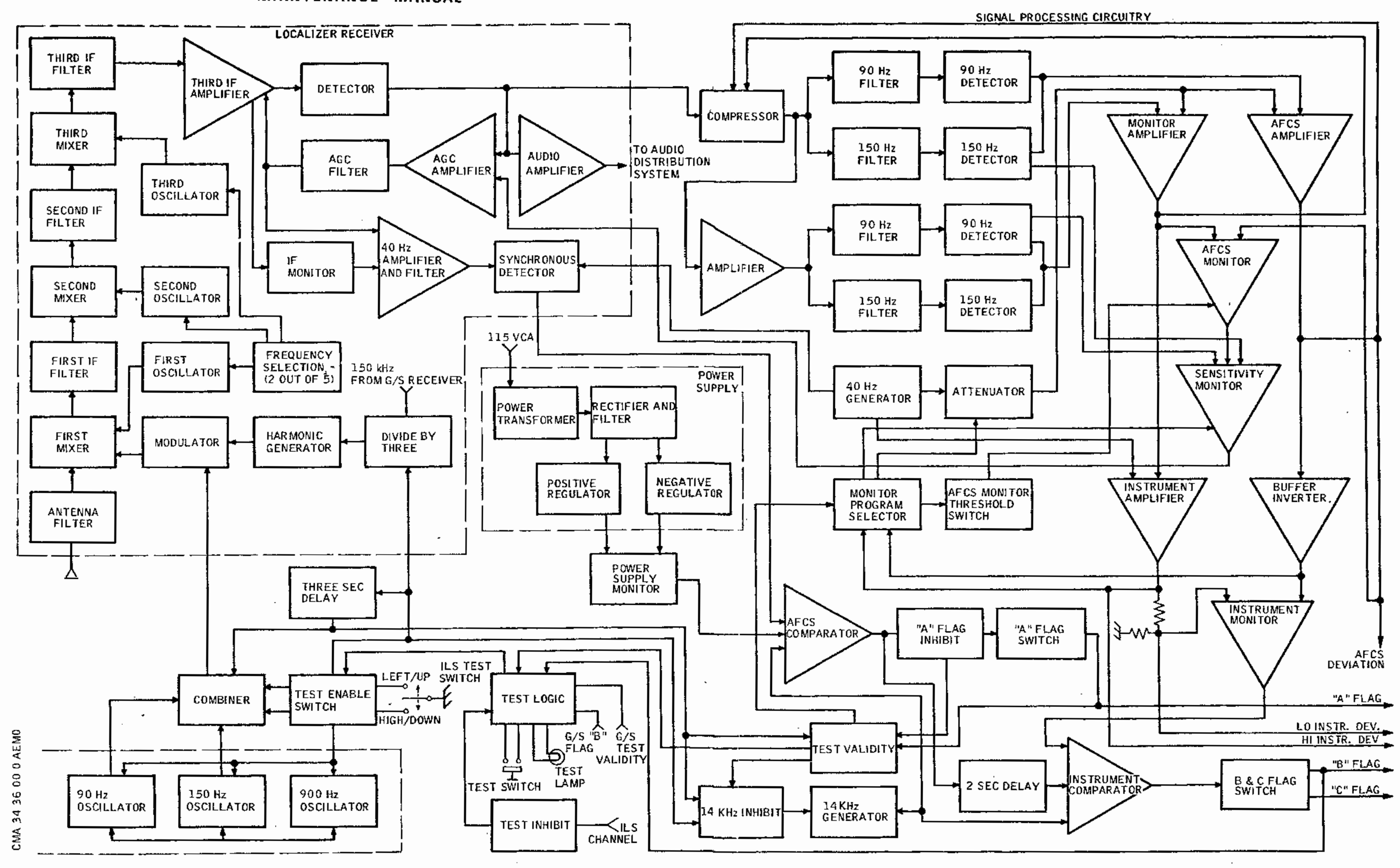
operate in a similar manner : conversion of glideslope and localizer beacon signals into electrical information, which is translated into horizontal and vertical guidance information by the indicators.

B. Operation (Ref. Fig.003 and 004)

(1) Localizer receiver

The LOCALIZER receiver is a triple-conversion crystal controlled superheterodyne. The antenna signal is applied to the first mixer through a band-pass filter. After mixing with the first oscillator frequency, the resultant intermediate frequency is passed through a 47.79 MHz tuned filter to the second mixer stage. The second oscillator frequency signal is also sent to the second mixer. The second intermediate frequency obtained is passed through a 6.975 MHz tuned filter to the third mixer stage to which is also sent the output frequency of the third oscillator. The resultant output, the third intermediate frequency, is 460 KHz. The third I.F., amplified and filtered, is

INTENTIONALLY BLANK



Localizer Receiver - Operation Block Diagram
Figure 003

R

then demodulated. After demodulation the signal is passed to the AGC amplifier, the audio amplifier and the compressor. The AGC circuit is monitored by the sensitivity monitor. The I.F. monitor monitors the two third I.F. stages.

(a) Monitor stage operation

The AGC circuit is monitored by the sensitivity monitor 40 Hz circuit. The amplified and filtered 40 Hz is fed to the synchronous detector. This stage detects and compares the amplified and filtered 40 Hz with the 40 Hz signal from the generator. The resultant DC signal is sent to the AFCS comparator. The magnitude and polarity of this voltage represents the phase difference between the two 40 Hz signals. If the preset AFCS comparator threshold is out of phase, this will inhibit the 14 KHz. The absence of this signal will cause the warnings to appear. The I.F. monitor monitors a DC voltage from the two third I.F. stages. An error at this point causes the monitor to send a signal to the 40 Hz amplifier and filter. This signal sends the amplifier into saturation. The disappearance of the 40 Hz signal at the synchronous detector causes dephasing of the AFCS comparator threshold, which generates the logic warning signal.

(b) Signal processing circuitry (After demodulation)

The function of these circuits is to process the 90/150 Hz signals so as to produce two outputs :

- AFCS deviation output
- instrument deviation

Each of these outputs is processed by a comparator based on the 40 Hz which monitors :

- Receiver performance
- Signal processing circuitry
- The validity of the input signal

After demodulation, the amplified 90/150 Hz signals are sent to the interphone circuit and to the compressor stage. This stage, controlled by feedback from the AFCS and monitor amplifiers compresses the audio signal when necessary in order to maintain at a maximum the deviation outputs within the specified limits, and in the

conditions encountered in ILS operation. The modulated signals from the compressor directly feed the 90 and 150 Hz filters of the AFCS channel and the similar filters of the instrument channel.

AFCS channel : the 90 Hz filtered output feeds the negative 90 Hz detector, the filtered 150 Hz output feeds the positive 150 Hz detector. The detector outputs are algebraically summed and the resultant output sent to the AFCS amplifier.

Instrument channel : Signal processing is identical except that the detector polarities are inverted. The resultant output is sent to the monitor amplifier. The 40 Hz generator signal is sent to the two stages of the monitor amplifier and the sensitivity monitor. AFCS deviation is directly available to the AFCS system via the rear connector, to the buffer inverter, to the compressor and to the AFCS monitor. This stage compares the deviation output of the AFCS amplifier and the inverted output of the monitor amplifier. If the outputs differ from the predetermined values, the AFCS monitor inhibits the 40 Hz signal. Absence of the 40 Hz generates the logic warning signal.
To ensure meanwhile that the AFCS amplifier and monitor, amplifier output signals are within limits, the 40 Hz is amplified and coupled to the sensitivity monitor to provide permanent monitoring of deviation sensitivity. The sensitivity monitor sums the AFCS channel 150 Hz and the 90 Hz of the instrument channel to monitor all changes in deviation sensitivity of the system. If the deviation is out of limits the sensitivity monitor inhibits the 40 Hz, which generates the warnings. The instrument amplifier receives the output of the monitor amplifier and provides directly the high and low level instrument deviation outputs by means of the rear connector. The high level output is also fed to the monitor program selector.
The buffer inverter isolates and inverts the AFCS amplifier deviation output. It supplies inputs to the instrument monitor and monitor program selector (This deviation output is completely independent of the deviation output of the monitor amplifier). The instrument monitor compares the outputs of the buffer inverter and instrument amplifier and thus monitors the instrument devia-

tions. When the difference between these outputs exceeds a predetermined level, a prohibition signal is sent to the instrument comparator which generates warnings B and C.
The monitor program selector acts as a switch to adjust the AFCS and sensitivity monitor levels according to conditions encountered in ILS operation. The threshold defined for intervention by the monitor program selector is a function of instrument deviation outputs from the instrument amplifier and buffer inverter. When the threshold is reached the monitor program selector performs the following switching operations :

(b1) The upper limit of the sensitivity monitor is suppressed. The result of this is that the sensitivity monitor only supplies a warning signal when deviation sensitivity exceeds 30% above or below the nominal level.

(b2) The AFCS monitor switch is activated, this raises the level at which the AFCS generates the logic warning signal.

(b3) The level of the 40 Hz signal provided by the attenuator is raised to compensate for the loss of gain of the AFCS monitor. During this operation the buffer inverter also prevents any malfunction which may occur in the monitor program selector from affecting the AFCS deviation output.

(c) Warning circuits

(c1) Logic flag "A", AFCS channel

When one of the following conditions arises, a warning logic signal is sent to the AFCS :

- Weak H.F. input signal
- Instrument and AFCS deviation outputs differ from the predetermined level.
- Deviation sensitivity differs from normal by + 50% - 30%.
- The level of the 40 Hz signal from the 40 Hz amplifier and filter exceeds the predetermined level.
- Error in the deviation information sent to the AFCS.
- System in test operation.
- Regulated power supply exceeds the prede-

termined level.

In normal operation the synchronous detector stage feeds the AFCS comparator, to which is also sent a summed component from the power supply monitor and a 14 KHz signal from the 14 KHz generator. The AFCS will only pass the 14 KHz if :

- The synchronous detector output is within the prescribed limits.
- The outputs of the power supply regulators are within the prescribed limits.
- The ILS test or self-test are not in operation.

Inhibition of the 14 KHz generates the warning via the A flag inhibit and A flag switch.

(c2) Flag B and C logic, instrument channel

The instrument logic switching is such that flags B and C are not visible on the instruments during normal use and appear when an Invalid condition exists. Three inputs are received at the instrument comparator :

- The 14 KHz from the generator
- The DC voltage from the two second delay
- The DC voltage from the instrument monitor

When one of the two DC voltages is not present at the input of the instrument comparator, the inhibition of the 14 KHz detected by the B and C flag switch stage causes the appearance of the warning flags as long as this condition exists.
In correct operation the 14 KHz output of the AFCS comparator is detected and the resulting DC voltage is sent to the two second delay stage. This stage delays the input of this voltage into the instrument comparator. After this delay, if the correct operation condition B maintained the instrument comparator inputs are normal and the warning flags are held in the non-visible position by means of the B and C flag switch. When the fault condition arises, inhibition of the DC voltage is delayed for two seconds. If the fault condition is still present

after this delay, the input is removed from the instrument comparator which causes the appearance of the warning flags by means of the B and C flag switch.

(2) Glideslope receiver

The Glideslope receiver is a triple conversion crystal controlled syperheterodyne. The working frequency is automatically matched with that of the LOCALIZER by means of the control box.
The antenna signal is passed through a filter to the first mixer stage. The local oscillator frequency applied to the stage through a filter is obtained by tripling one of the twenty basic frequencies of the first crystal controlled oscillator. The first intermediate frequency obtained is passed through a filter to the second mixer.
Where it is mixed with the output frequency of the second oscillator.
The second I.F. output is passed through a 5.6 MHz tuned filter and then applied to the third mixer, to which is also sent the output frequency of the third oscillator. The third I.F. output is passed through the 526 KHz third I.F. filter. The third I.F. signal is amplified by the third I.F. amplifier stage and
R then demodulated by the detector. The signal is sent to the AGC amplifier and to the compressor.

NOTE : The operation of the monitoring signal processing and warning circuitry is analagous with that of the localizer receiver and will not be described. See (b) to (c) (a2) inclusive.

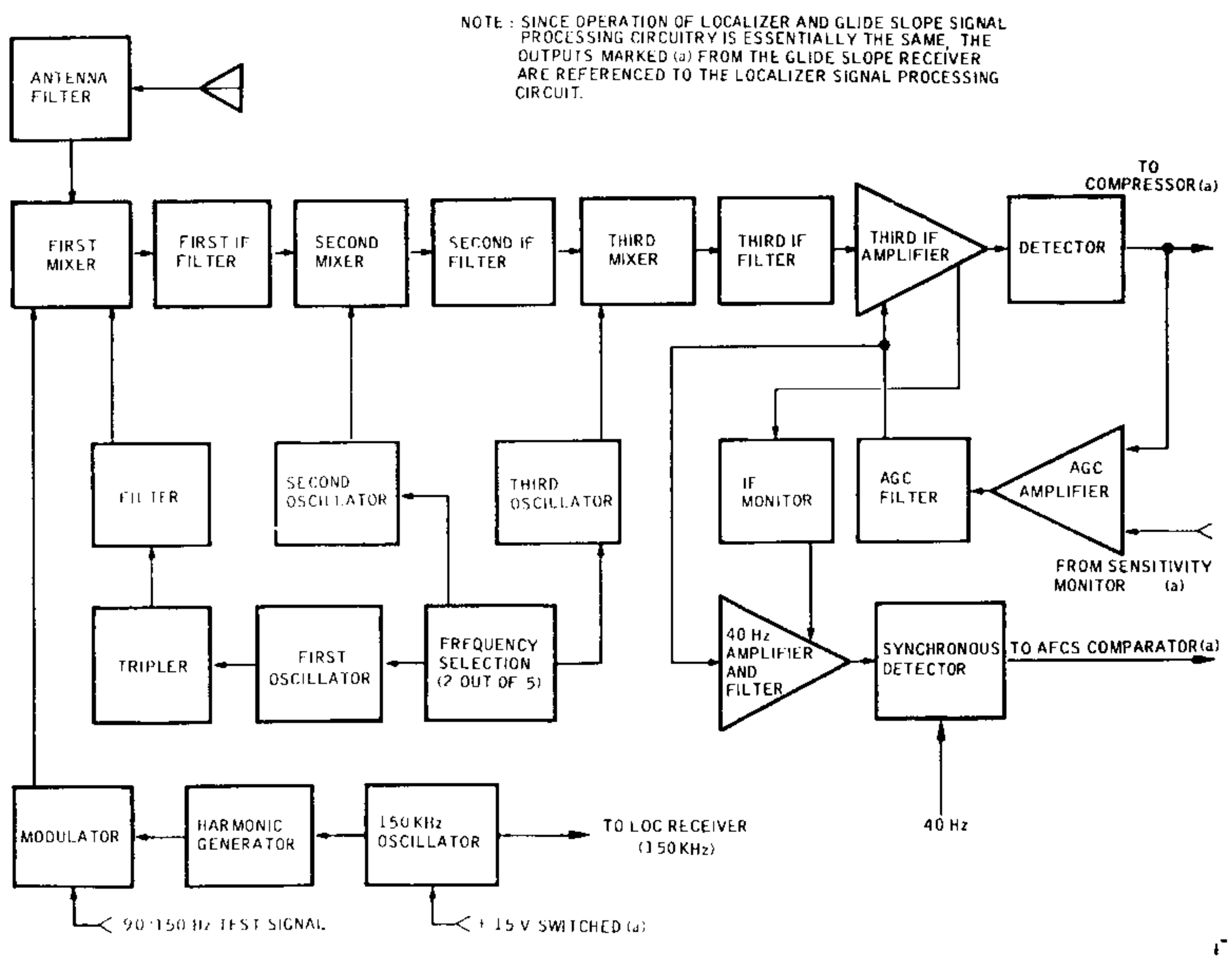
(3) Self-test circuitry

(a) Description

The circuitry consists of TEST logic stages, TEST enable switch, TEST validity circuit, 14 KHz tracer inhibit, modulated generator (90-150-900 Hz), combiner and three second delay. The purpose of the self-test circuitry is to generate modulated signals, which are injected into the first mixer stages of the receivers and processed normally. This test operation provides information on receiver performance.

(b) Operation

The test can be initiated in two ways :



GLIDESLOPE Receiver - Operation Block Diagram
Figure 004

- Locally by depressing the TEST push-button
- Remotely by the ILS test switch on the control box (3-position switch).

(c) Self-Test

Depression of the TEST push-button initiates the self-test. The TEST logic controls the test sequence -approximately 12 seconds- activates the test enable switch and applies voltage to the TEST lamp which illuminates. The receivers process the injected signals, TEST logic monitors the warning circuits, A through TEST validity circuit, and B and C. If the test is satisfactory the TEST lamp extinguishes, this provides a visual indication of the operational condition of the receivers. If the test reveals a fault, TEST logic maintains the lamp illuminated after the self-test period, even through the system is again in normal reception operation, this provides the fault indication.

(d) ILS test

Placing of the switch in the UP/L position initiates the test which generates 150 Hz predominant signals. The signals processed in the receiver are fed to the associated deviation circuits according to the following sequence :

- When the switch is activated, warning flags A, B and C appear. Six seconds later the flags disappear, warning flag A reappears after approximately 100 milliseconds and remains visible for the duration of the test.
- Approximately three seconds after placing the switch in the UP/L position the deviation outputs appear (half-scale to the left, half-scale upwards on the indicators). The deviations remain until the switch is returned to the central position.
- Approximately twelve seconds after positioning the switch the warning flags reappear, this terminates the test sequence. The switch should be replaced in the central position.

R When the switch is placed in the DN/R position the 90 Hz signal is dominant. The receivers process the signal as described above except that the deviations will be : half-scale to the right, half-scale downwards.

R 4. Antenna-VOR Type ACVO 102 or CHELTON 19-182
(Ref. Fig.005 and 006)

A. Description

The VOR antenna is used either in VOR radio navigation or in LOCALIZER operation. The installation of two hybrid couplers brings about a net improvement in the reduction of error between the two LOC information signals. From the couplers the switching to the receivers, either VOR or LOC is made by means of a coaxial relay energized from the system control panel. With the relay energized, the antenna is switched to the localizer receiver. The VOR antenna is an external low-drag antenna, composed of two identical half-antennas (ACVO 1020) mounted horizontally at each side of the fin, near the top.
A 1/2 antenna is composed of 4 parts :

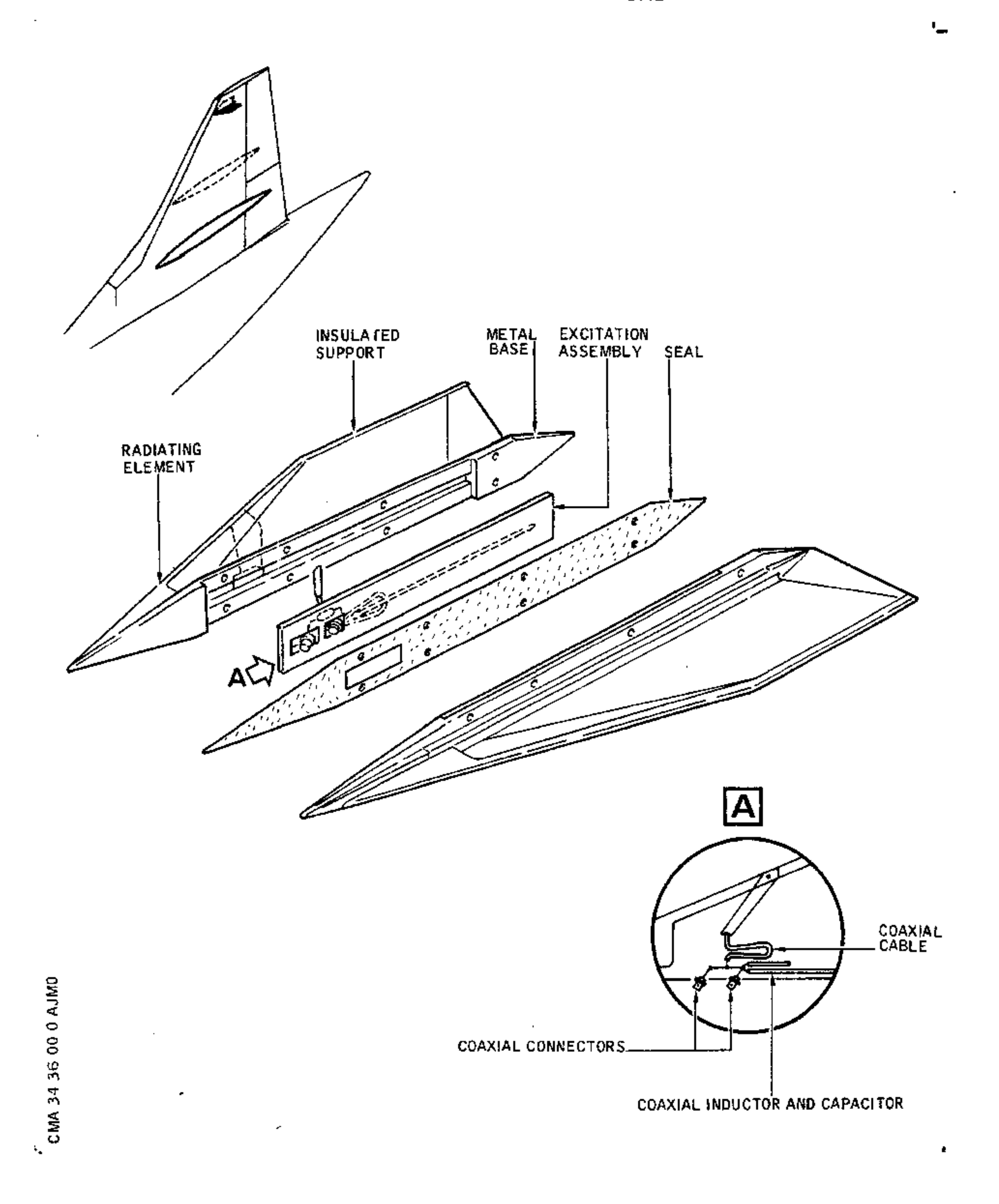
- The metal mounting base
- The high-temperature glass reinforced plastic insulated support.
- The antenna radiating element consisting of the metal fin mounted on the insulated support.
- An excitation assembly which connects the antenna to the coaxial cable by means of an adapter circuit in the form of a baseplate on which are soldered :
  - a coaxial stub - a parallel oscillating circuit composed of coaxial elements - two coaxial output connectors in parallel. From each 1/2 antenna, two coaxial cables of equal length feed each of the hybrid couplers.
    The couplers are mounted transversally in the fin, near the antennas (Ref. 34-55-11, Removal/Installation).
    Access to the couplers without performing any intervention on the antennas in gained through access door QR 123.

B. Operation

The antenna is normally used to supply 2 receivers. It operates in the 108 - 118 MHz band with horizontal polarization. The receiver inputs are in opposite phase which provides practically omnidirectional coverage in the horizontal plane. The impedance of each half of the antenna is 25 ohms. The SWR is a maximum of 5.

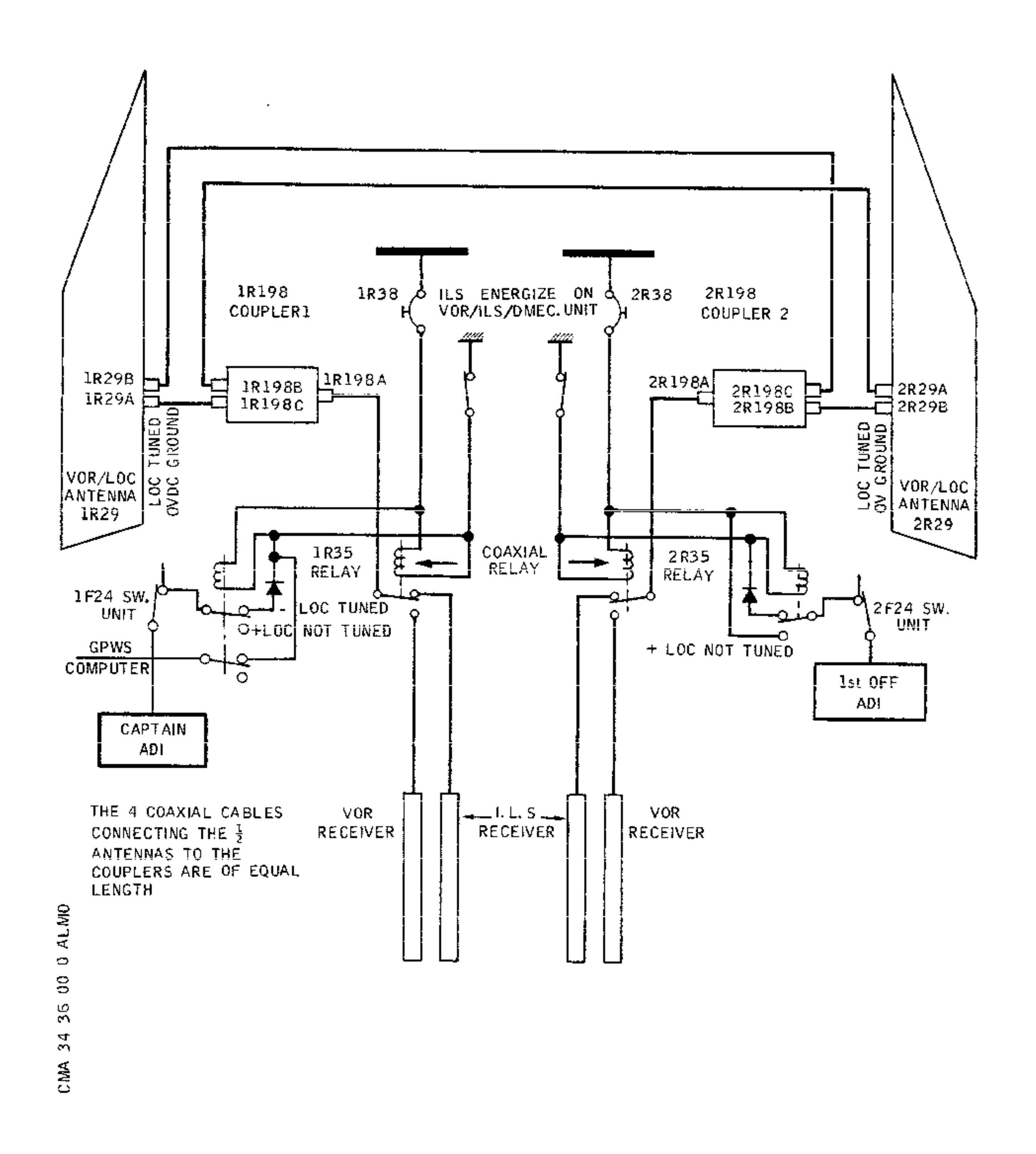
R 5. Antenna-VHF - GLIDE Type ACGL 102 or CHELTON 19-180
(Ref. Fig. 007)

A. Description



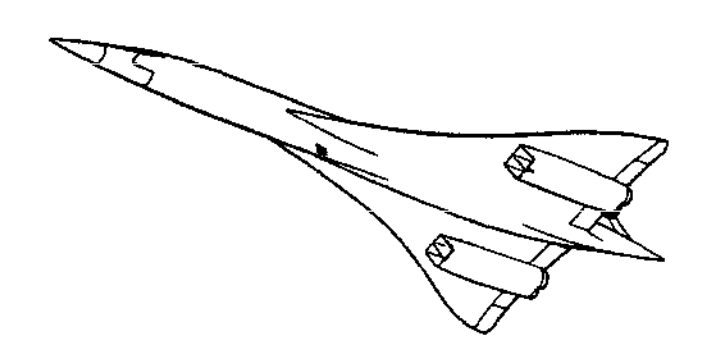
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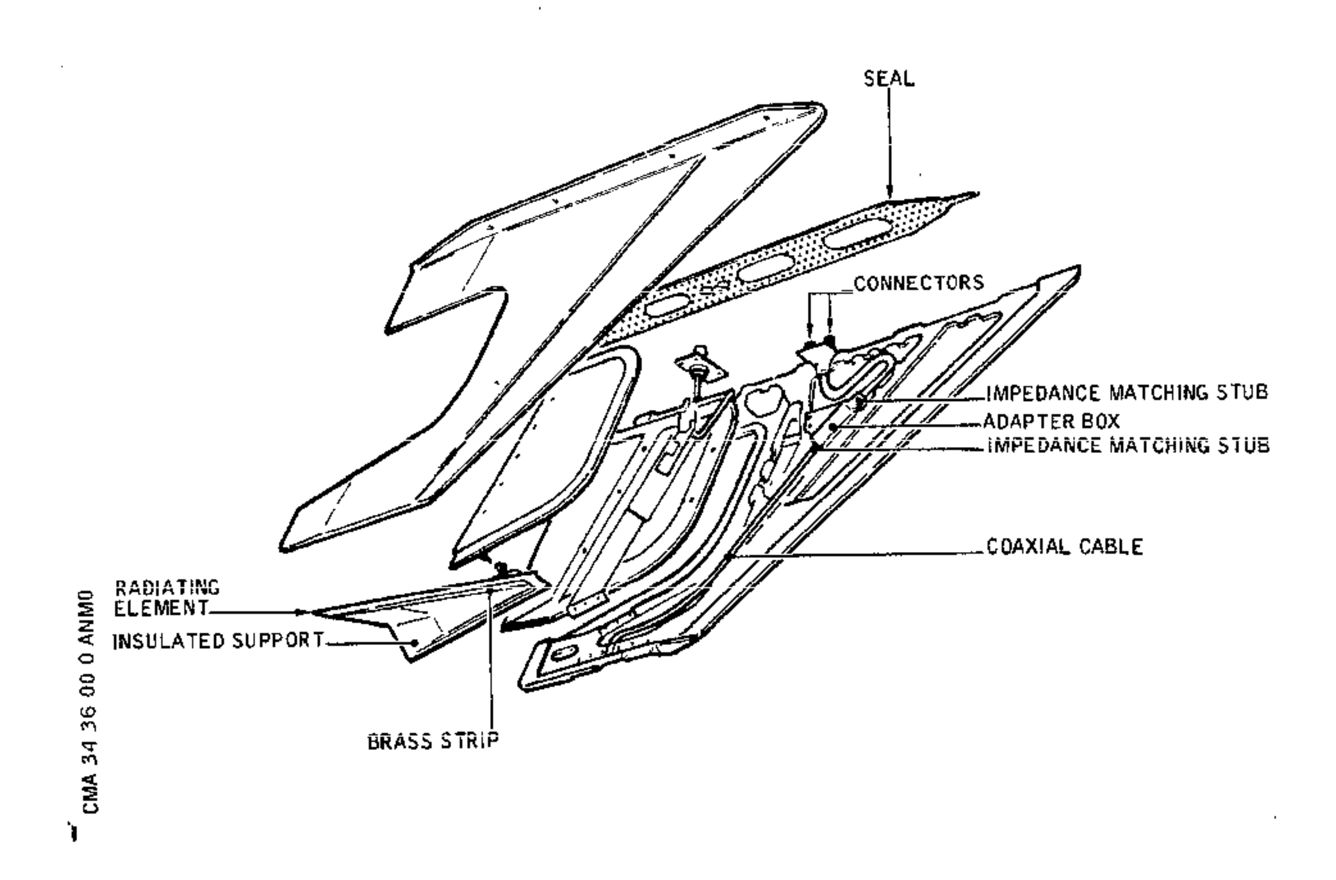
VOR/LOC Antenna, Exploded View
Figure 005



VOR/LOC - Connections
Figure 006

R





VHF GLIDE Antenna : Exploded View
Figure 007

The VHF - GLIDE antenna is used for VHF operation and for glide path reception required by the ILS receiver. It is an external low-drag antenna mounted in the symmetry plane on the underside of the aircraft fuselage. It is composed of two electrically separate antennas mounted on the same mechanical support vertically orientated in the aircraft symmetry plane on the underside of the fuselage. The glide path antenna is in the form of a flat horizontal spearhead mounted at the upper extremity of the VHF antenna. It consists of 4 parts :

- The high temperature glass reinforced plastic insulated support fitted on the top of the VHF antenna.
- The radiator consists of a silver-plated V-shaped brass element fitted to the leading edge of the antenna.
- Antenna excitation is made by two brass strips embedded in the insulated support.
- The coaxial cables of length L and l + lambda/2 are connected between the 2 brass strips and an adapter box which allows the adjustment of antenna impedance to 25 ohms.
- Two coaxial cables connect the adapter box to the antenna connectors.

B. Operation

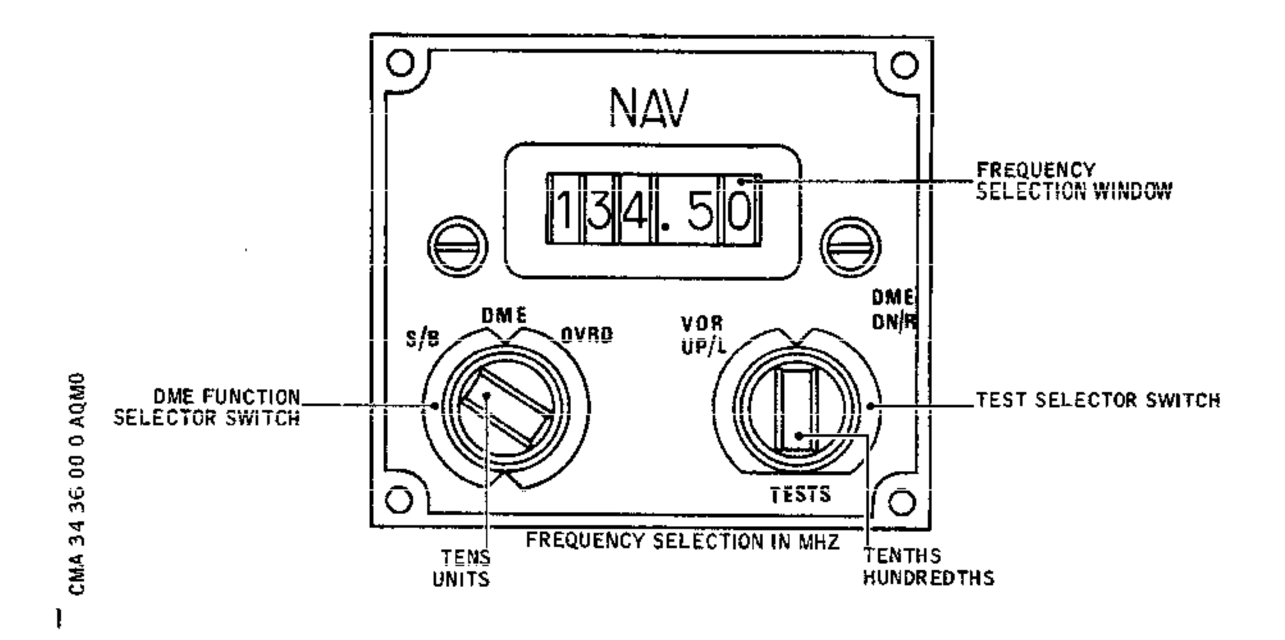
The GLIDE PATH antenna element operates in the 329 - 336 MHz band with horizontal polarization. SWR is a maximum of 5.

6. Control Box - VOR/ILS/DME EAS BN 1671D (PN5002100006) (Ref. Fig. 008)

A. Description

The control box is rectangular in shape. On the front panel, at the lower left, 2 concentric selector switches are mounted, the exterior switch having 3 positions S/B - DME - OVRD (Standby - DME - Override) is used for remote control of the DME system. The central pointer knob enables selection of tens and units of MHz. At the lower right the 3 way TEST switch is used to select TEST VOR-ILS or DME (the switch returns automatically to neutral position). The central pointer knob enables frequency selection of tenths and hundredths of MHz. At the center of the front panel the frequency selected is displayed in a window. White internal and window illumination is provided. System interconnection is made by means of a connector on the rear panel.

B. Operation



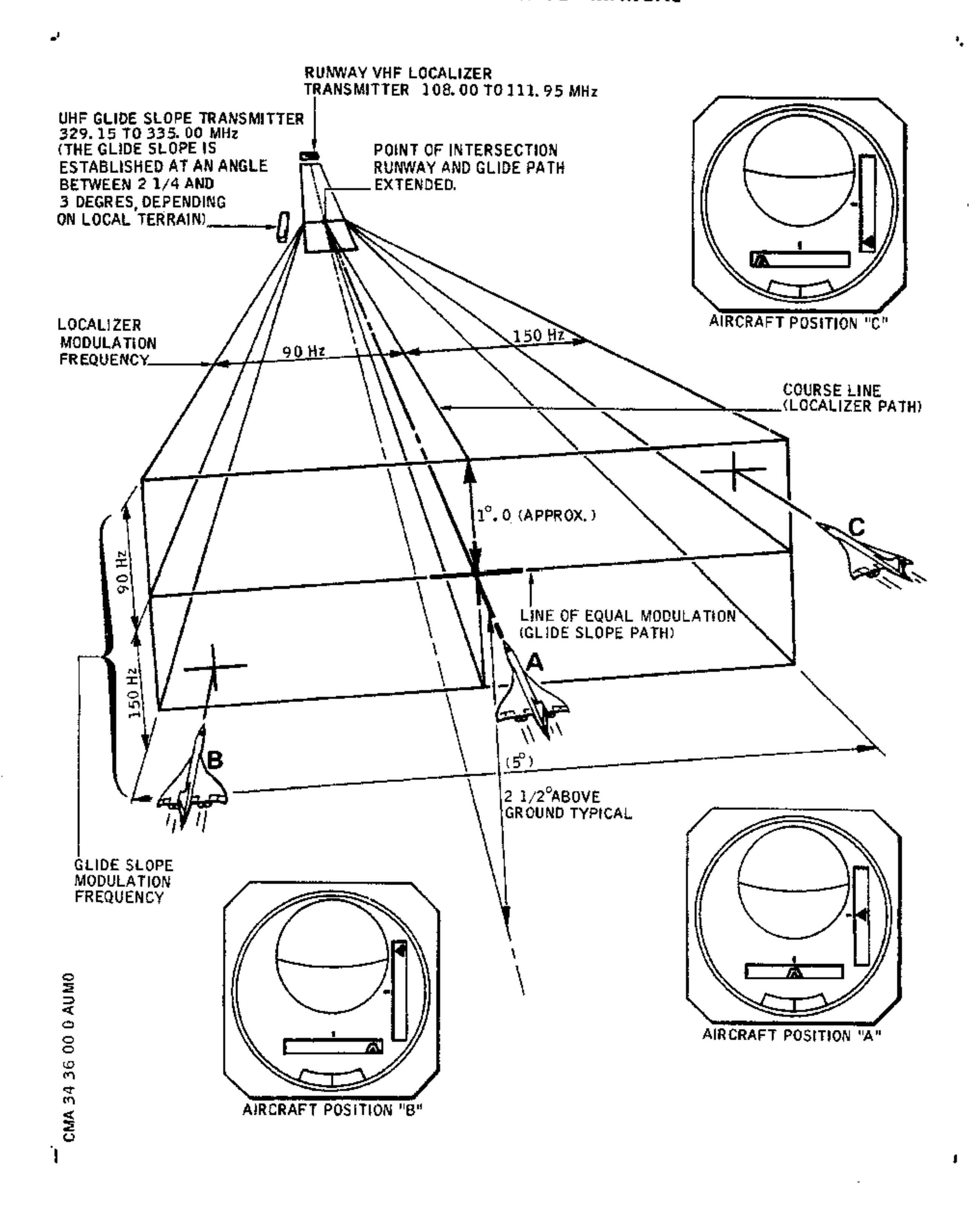
Control Box : Front View
Figure 008

Remote control of the VOR-ILS-DME systems is made by the two OUT OF FIVE BINARY CODE method (40 ILS channels) in the 108 to 111.95 MHz band. The DME frequency is determined by the choice of the selected VOR channel. Control is made by a resistance bridge (The DME TEST function is inhibited when automatic pilot is engaged). The VOR has 160 channels spaced at 50 KHz intervals in the 108 to 111.95 MHz band. The VOR-ILS antenna switch coaxial relay is energized by switching of an internal wafer.

7. ILS System Operation

A. Ground Installation (Ref. Fig. 009)

The glideslope transmission signal (329.15 to 335 MHz) is beamed in such a manner as to produce the intersection of the upper and lower lobes along a predetermined axis which defines the rate of descent in order to land on the beam path. This axis forms an angle of 2.5 degrees with the ground at the threshold of the path. The upper lobe of the glide path beam is modulated at 90 Hz, the lower lobe at



Typical Position on Instrument Panel Indicator
Determination of Axes by the Beacons
Figure 009

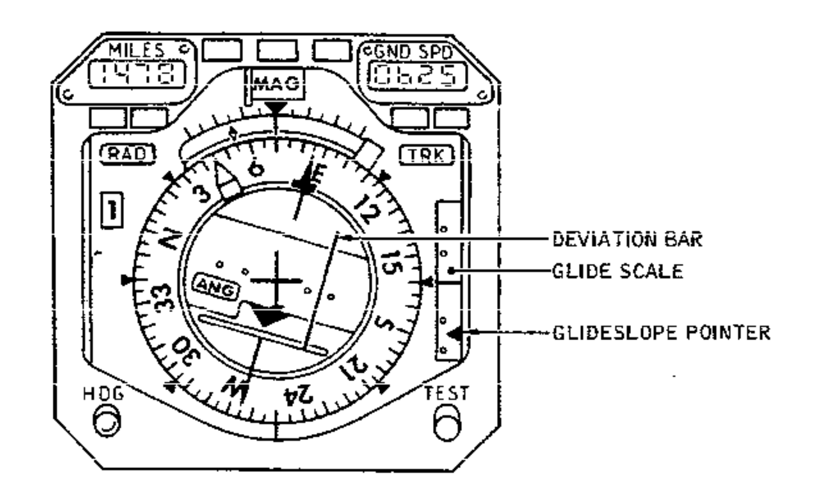
150 Hz. The line of equal modulation defines the descent path. The GLIDESLOPE receives compares and detects the received signals, modulated at 90 and 150 Hz. The resultant output applied to the glide pointer of the HSI indicator gives a visual indication of aircraft vertical guidance. The localizer transmission signal (108 to 111.95 MHz) is beamed in such a manner as to position the intersection of the right and left lobes along the center line of the landing path. The right lobe signal is modulated at 150 Hz, left lobe signal modulation is at 90 Hz. The right hand sector of the path is defined in direction at a distance of approximately 4.6 mm by the outer marker beacon. The localizer receiver compares and detects the signals received, the resultant output is applied to the vertical bar of the HSI indicator, the bar gives a visual indication of aircraft lateral guidance.

B. Navigation Operation

When the aircraft is flying at the intersection of the axes defined by the glideslope and localizer beacons, the aural signal of equal modulation is received by the aircraft ILS system, the vertical and horizontal guidance information is sent to the HSI and ADI indicators and to the AFCS. The bar and pointer indicators are centered (aircraft in position A on the diagram). This is the ideal presentation to be maintained by the pilot or autopilot.
When the aircraft is flying to the left of the localizer axis and below the glide axis the 90 Hz modulation is stronger in localizer and the 150 Hz modulation is stronger in glideslope.
On the indicators the pointers will indicate "To the right" and "To climb" (aircraft in position B on the diagram).
The corrections are to be made by the pilot or autopilot.
When the aircraft is flying to the right of the localizer axis and above the glide axis, the 150 Hz modulation is stronger in localizer, the 90 Hz modulation is stronger in Glide. On the indicators the pointers will indicate "To the left" and "To descend" (aircraft in position C on the diagram). The corrections are to be made by the pilot or autopilot.

C. Indicators (Ref. Fig.010 and 011)

The HSI (Horizontal Situation Indicator) and ADI (Attitude Director Indicator) indicators used in the ILS system have multiple functions, one of which is the indication of ILS information. These indicators supply the relative position of the aircraft with respect to the ILS glide path beam. This position information is indicated by means of the appropriate pointers controlled by the deviation infor-



CMA 34 36 00 0 AWM0

HSI : Indicator Front View
Figure 010

mation supplied by the ILS receiver.

D. Warnings

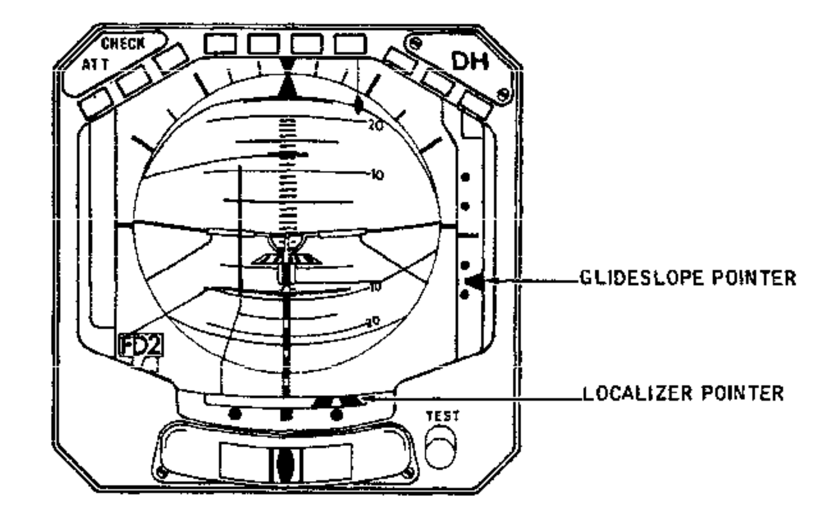
If a fault condition arises in one of the two receivers when the ILS system is in use, the appropriate warning flag appears on the indicators. Warning information is also sent to the AFCS system.

E. AFCS (Automatic flight control system)

Warning and deviation information supplied by the ILS receivers is available to this system and are used :

- In automatic landing procedure
- in VOR/LOC mode
- in GLIDE mode

The pilot thus has available the necessary controls and warnings on the AFCS control and mode indication box. Finally, receiver deviation output information is sent to the flight data recorder.



CMA 34 36 00 0 AYM0

ADI : Indicator Front View
Figure 011

F. GPWS (Ground Proximity Warning System)

Deviation and warning information from Glidescope receiver No.1 is used in the GPWS computer.

G. Switching of ILS Information to Indicators

(1) On Captain instrument panel 2-211, a DEV1/DEV2 switch 1R26 enables switching to the HSI and ADI indicators of either ILS1 or ILS2 system information.
On First Officer instrument panel 2-212, a DEV1/DEV2 switch 2R26 similarly enables switching of systems 1 or 2 to the First Officer indicators.
Switches 1R26 and 2R26 respectively control switch 1F24 VOR-ILS1 and 2F24 VOR-ILS2 included in RAD/INS SW UNIT 1F24. Wiring of the 2 switches prohibits cross connection of information between instrument panels, when selection has been made on one switch, switching of the other has no effect.

(2) LOC NOT TUNED (+28VDC) ILS receiver not in operation

and LOC TUNED (OVGROUND) information ILS frequency selected is distributed by contacts A3 and A1 respectively of relays 1 and 2R35 energized from the VOR/ ILS/DME control units. The information is passed through the switching unit. LOC NOT TUNED enables the pointer and ILS warning flag to be held out of view.

(3) ILS1 information is connected directly to the GPWS computer through a contact of relay 1R35, to authorise mode 5.

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ILS - TROUBLE SHOOTING

CAUTION : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, TROUBLE SHOOTING.

1. General

The following trouble shooting procedures are intended to enable faults found on the ground or in flight to be quickly rectified. The defect can be isolated with the aid of trouble shooting procedures (Ref. para 3) and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary, then repeat the operation at which the defect was encountered to ensure the operation is OK.
Bracketed mumbers in the procedures and charts indicate items on the component identification table (Ref. Table 101).
The table provides information, including component location, required for rectification.
All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated Circuit breakers are set and electrical power is available, unless otherwise stated, If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).
As the two systems are identical, trouble shooting procedure is described for system 1. System 2 trouble shooting procedure is similar, with the system number replaced by the number in parentheses.

2. Prepare

A. Switching. State of system before start. (ref. 34-36-00-5B).

3. Trouble Shooting

```
*****************************************************
* On VOR/ILS/DME1 [1] ([2]) control unit select an  *
* ILS frequency on which no signal is received. On  *
* Captain [3] (First Officer [4]) HSI, RAD, MAG,    *
* and 1 [2] markers are visible. NAV and GS flag is *
* visible. GLIDE pointer is retracted, lateral dev- *
* iation bar is centred. On Captain ADI [5] (First  *
* Officer [6]. LOC and GS flags are visible. GLIDE  *
* and LOC pointers are retracted.    IF.            *
*****************************************************
   ||   |
   ||   |             -------------------------------------------------
   ||   |             | LOC and GS flags retracted on ADI, no signal on|
   ||   |--NOT OK--| ILS frequency, replace control unit [1] ([2]).  |
   ||   |             -------------------------------------------------
   ||   |
   ||   |             -------------------------------------------------
   ||   |             | Check power supply 1R35 relay [1] ([8]), 28VDC |
   ||   |--NOT OK--| at output of circuit breaker 1R38 [9] ([10]).   |
   ||   |             -------------------------------------------------
   ||   |                       |                         |
   ||   |                       OK                     NOT OK
   ||   |                       |                         |
   ||   |             -------------------------  --------------------
   ||   |--NOT OK--| Replace relay [1] ([8])|  | Replace circuit    |
   ||   |             -------------------------  | breaker [9] ([10]).|
   ||   |                                        --------------------
   ||   |
   ||   |             -------------------------------------------------
   ||   |--NOT OK--| RAD MAG markers not visible on HSI             |
   ||   |             | Ref. Chart 101.                                |
   ||   |             -------------------------------------------------
   ||   |
   ||   |             -------------------------------------------------
   ||   |--NOT OK--| 1 [2] marker not visible on HSI                |
   OK                 | Ref. Chart 102.                                |
   ||                 -------------------------------------------------
   ||
   ||
```

On VOR/ILS/DME control unit, hold TESTS selector switch in UP/L position, check test sequences on instruments :

SEQUENCES	On ADI in operation	On HSI in operation
Initial	GS and LOC flags visible. GS and LOC pointers retracted.	NAV and GS flags visible. GS pointer disappears. Deviation bar centred.
After 6 seconds	LOC and GS flags disappear. LOC pointer goes to LH stop GS pointer deviates 1 point upwards.	NAV and GS flags disappear. GS pointer deviates one point upwards. Deviation bar moves one point to left.
After 12 sefonds	LOC and GS flags return to view. LOC and GS pointers are retracted.	NAV and GS FLAGS return to view.

Release TESTS selector switch. Initial indications reappear on ADI and HSI. IF

-NOT OK- Self test does not operate. Ref. Chart 103

-NOT OK- LOC flag does not disappear on ADI. Ref. Chart 104.

-NOT OK- GS flag does not disappear on ADI. Ref. Chart 105.

-NOT OK- LOC pointer does not move from stop on ADI Ref. Chart 106.

OK

-NOT OK- GS pointer does not deviate 1 point upwards on ADI Ref. Chart 107.

-NOT OK- GS flag does not disappear on HSI. Ref. Chart 108.

-NOT OK- NAV flag does not disappear on HSI. Ref. Chart 109.

-NOT OK- GS pointer does not deviate 1 point upwards on HSI Ref. Chart 110.

=NOT OK- Lateral deviation bar does not deviate 1 point to left on HSI. Ref. Chart 111.

OK

Continue test with selector switch in DN/RT position.

SEQUENCES	On ADI in operation	On HSI in operation
After 6 seconds	Loc and GS flags retracted. LOC pointer goes to RH stop. GS pointer deviates 1 point downwards.	NAV and GS flags retracted. GS pointer deviates 1 point downwards. Deviation bar moves 1 point to right.
After 12 seconds	LOC and GS flags return to view. LOC and GS pointers are retracted.	NAV and GS flags return to view. IF

-NOT OK- Configuration incorrect. Replace ILS receiver [11] ([12]).

```
   OK
   ||
-----------------------------------------------------------
| Start up ground test unit on same frequency as         |
| that selected on control unit, switch to               |
| LOCALIZER function: On Captain (First Officer) HSI     |
| NAV flag disappears, lateral deviation bar is          |
| centred. On Captain (First Officer) ADI LOC flag       |
| disappears, LOC pointer is centred.         IF         |
-----------------------------------------------------------
   ||     |        --------------------------------------------------------
   ||     |-NOT OK-| LOC and NAV flags, do not disappear on HSI and |
   OK              | ADI          Ref. Chart 112.                  |
   ||              --------------------------------------------------------
-----------------------------------------------------------
| Switch to GLIDE function on ground test unit : On      |
| Captain (First Officer) HSI NAV flag disappears.       |
| GS pointer is centred. On Captain (First Officer)      |
| ADI GS flag disappears. GS pointer is centred,   IF    |
-----------------------------------------------------------
   ||     |        --------------------------------------------------------
   ||     |        | GS flags do not disappear on HSI and ADI       |
   OK     |-NOT OK-|            Ref. Chart 113.                     |
   ||              --------------------------------------------------------
-----------------------------------------------------------
| On ground test unit simulate vertical deviation        |
| UP and DOWN. On Captain (First Officer) HSI GS         |
| pointer deviates, on Captain (First Officer) ADI       |
| GS pointer deviates.                                   |
-----------------------------------------------------------
   ||     |        --------------------------------------------------------
   OK     |-NOT OK-| Replace ILS receiver [11] ([12]).              |
   ||              --------------------------------------------------------
-----------------------------------------------------------
| On ground test unit simulate LOC deviation LEFT        |
| and RIGHT. On Captain (First Officer) HSI lateral      |
| deviation bar deviates, on ADI LOC pointer deviat-     |
| es.                                                    |
-----------------------------------------------------------
   ||     |        --------------------------------------------------------
   ||     |-NOT OK-| Replace ILS receiver [11] ([12]).              |
   ||              --------------------------------------------------------
   ||
   ||
   ||
   ||
   ||
   ||
   ||
```

```
***************************************
* RAD MAG MARKERS NOT VISIBLE ON HSI *
***************************************

---------------------------------------       ----------------------
| Check circuit breaker [13] ([14])   |--NO--| Replace circuit     |
| 28VDC at output.                    |      | breaker [13] ([14])|
---------------------------------------       ----------------------
                   |
                  YES
                   |
---------------------------------------
| Replace RAD/INS selector switch     |
| [17] ([18]).                        |
---------------------------------------
                   |
                  NO
                   |
---------------------------------------
| Replace HSI indicator [3] ([4]).    |
---------------------------------------
                   |
                  NO
                   |
---------------------------------------
| Replace RAD/INS switch [15] ([16]).|
---------------------------------------
```

Chart 101

```
*************************************
* 1 (2) MARKER NOT VISIBLE ON HSI.  *
*************************************

-------------------------------------         ---------------------
| RAD and MAG markers are visible :  |--NO--| Replace circuit     |
| check circuit breaker [19] ([20]). |      | breaker [19] ([20])|
-------------------------------------         ---------------------
                  |
                 YES
                  |
-------------------------------------
| Replace VOR/ILS1-VOR/ILS2 selector |
| switch [17] ([18]).                |
-------------------------------------
                  |
                  NO
                  |
-------------------------------------
| Replace HSI [3] ([4]).             |
-------------------------------------
                  |
                  NO
                  |
-------------------------------------
| Replace DEV1/DEV2 switch [23]      |
| ([24]).                            |
-------------------------------------
```

Chart 102

```
************************************
* NO SELF TEST OPERATION           *
************************************

--------------------------------------       -----------------------
| FAULT warning light on ILS receiver|       | Replace ILS receiver|
| front panel remains illuminated.   |-YES-| [11] ([12])         |
--------------------------------------       -----------------------
                  |
                  NO
                  |
--------------------------------------       -----------------------
| Carry out self test by means of    |       | Replace Control Unit|
| push button on ILS receiver front  |-YES-| [1] ([2]).          |
| panel.                             |       -----------------------
--------------------------------------
                  |
                  NO
                  |
--------------------------------------       -----------------------
| Check circuit breaker [25] ([26])  |       | Replace circuit     |
| 115 VAC 400 Hz.                    |--NO-| breaker [25] ([26]) |
--------------------------------------       -----------------------
                  |
                  YES
--------------------------------------
| Replace ILS receiver [11] ([12]).  |
--------------------------------------
```

Chart 103

```
*************************************
* LOC FLAG DOES NOT DISAPPEAR ON ONE *
* ADI                                *
*************************************

-------------------------------------          -----------------------
| By means of DEV1/DEV2 switches,   |          | Replace ILS receiver |
| supply information to both ADI    |--NO--| [11] ([21]).         |
| units from the same system.       |          -----------------------
-------------------------------------
                 |
                YES
                 |
-------------------------------------
| Replace faulty ADI.               |
-------------------------------------
                 |
                NO
                 |
-------------------------------------
| Replace VOR/ILS1-VOR/ILS2 selector |
| switch [17] ([18]).                |
-------------------------------------
```

Chart 104

```
**************************************
* GS FLAG DOES NOT DISAPPEAR ON ONE  *
* ADI.                               *
**************************************

--------------------------------------      ------------------------
| By means of DEV1/DEV2 switches,    |      | Replace ILS receiver |
| supply information to both ADI     |--NO--| [11] ([12]).         |
| units from the same system.        |      ------------------------
--------------------------------------
                  |
                 YES
                  |
--------------------------------------
| Replace faulty ADI                 |
--------------------------------------
                  |
                  NO
                  |
--------------------------------------
| Replace VOR/ILS1-VOR/ILS2 selector |
| switch [17] ([18]).                |
--------------------------------------
```

Chart 105

```
**************************************
* LOC POINTER DOES NOT GO TO STOP ON *
* ONE ADI.                           *
**************************************

--------------------------------------       ------------------------
| By means of DEV1/DEV2 switches,    |       | Replace ILS receiver |
| supply information to both ADI     |--NO--| [11] ([12]).         |
| units from the same system.        |       ------------------------
--------------------------------------
                  |
                 YES
                  |
--------------------------------------
| Replace faulty ADI                 |
--------------------------------------
                  |
                  NO
                  |
--------------------------------------
| Replace VOR/ILS1-VOR/ILS2 selector |
| switch [17] ([18]).                |
--------------------------------------
```

Chart 106

```
**************************************
* GS POINTER DOES NOT DEVIATE ONE    *
* POINT UPWARDS ON ONE ADI           *
**************************************

--------------------------------------      ------------------------
| By means of DEV1/DEV2 switches,    |      | Replace ILS receiver |
| supply information to both ADI     |--NO--| [11] ([12]).         |
| units from the same system.        |      ------------------------
--------------------------------------
                  |
                 YES
                  |
--------------------------------------
| Replace faulty ADI                 |
--------------------------------------
                  |
                  NO
                  |
--------------------------------------
| Replace VOR/ILS1-VOR/ILS2 selector |
| switch [17] ([18]).                |
--------------------------------------
```

Chart 107

```
*************************************
* GS FLAG DOES NOT DISAPPEAR ON ONE  *
* HSI.                               *
*************************************

-------------------------------------         -----------------------
| By means of DEV1/DEV2 switches,   |         | Replace ILS receiver |
| supply information to both HSI    |--NO--| [11] ([12]).          |
| units from the same system.       |         -----------------------
-------------------------------------
                 |
                YES
                 |
-------------------------------------
| Replace faulty HSI.               |
-------------------------------------
                 |
                NO
                 |
-------------------------------------
| Replace RAD/INS selector switch   |
| [17] ([18]).                      |
-------------------------------------
```

Chart 108

```
*************************************
* NAV FLAG DOES NOT DISAPPEAR ON ONE *
* HSI.                               *
*************************************

--------------------------------------           -----------------------
| By means of DEV1/DEV2 switches,     |          | Replace ILS receiver |
| supply information to both HSI      |--NO--|   [11] ([12]).         |
| units from the same system.         |          -----------------------
--------------------------------------
                  |
                 YES
                  |
--------------------------------------
| Replace faulty HSI.                 |
--------------------------------------
                  |
                  NO
                  |
--------------------------------------
| Replace RAD/INS selector switch     |
| [17] ([18]).                        |
--------------------------------------
```

Chart 109

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```
*************************************
* GS POINTER DOES NOT DEVIATE ONE   *
* POINT UPWARDS ON ONE HSI.         *
*************************************

-------------------------------------      -----------------------
| By means of DEV1/DEV2 switches,   |      | Replace ILS receiver |
| supply information to both HSI    |--NO--| [11] ([12]).         |
| units from the same system.       |      -----------------------
-------------------------------------
                 |
                YES
                 |
-------------------------------------
| Replace faulty HSI.               |
-------------------------------------
                 |
                NO
                 |
-------------------------------------
| Replace RAD/INS selector switch   |
| [17] ([18].                       |
-------------------------------------
```

Chart 110

```
**************************************
* LATERAL DEVIATION BAR DOES NOT     *
* DEVIATE ONE POINT TO LEFT ON HSI.  *
**************************************

--------------------------------------        ------------------------
| By means of DEV1/DEV2 switches,    |        | Replace ILS receiver |
| supply information to both HSI     |--NO--| [11] ([12]).         |
| units from the same system.        |        ------------------------
--------------------------------------
                  |
                 YES
                  |
--------------------------------------
| Replace faulty HSI.                |
--------------------------------------
                  |
                 NO
                  |
--------------------------------------
| Replace RAD/INS selector switch    |
| [17] ([18]).                       |
--------------------------------------
```

Chart 111

```
***************************************
* NAV AND LOC FLAGS DO NOT DISAPPEAR *
* ON HSI AND ADI.                     *
***************************************

---------------------------------------
| Replace ILS receiver [11] ([12]).   |
---------------------------------------
                  |
                  NO
                  |
---------------------------------------
| Check frequency displayed on cont-  |
| rol unit. Replace control unit [1]  |
| ([2]).                              |
---------------------------------------
                  |
                  NO
                  |
---------------------------------------
| Replace coaxial relay [21] ([22])   |
---------------------------------------
                  |
                  NO
                  |
---------------------------------------
| Replace coupler [27] ([28]).        |
---------------------------------------
                  |
                  NO
                  |
---------------------------------------
| Replace antenna [29] ([30]).        |
---------------------------------------
```

Chart 112

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```
************************************
* GS FLAG DOES NOT DISAPPEAR ON HSI  *
* AND ADI.                           *
************************************

------------------------------------
| Replace ILS receiver [11] ([12]).  |
------------------------------------
                  |
                  NO
                  |
------------------------------------
| Check frequency display on control |
| unit. Replace control unit [1]     |
| ([2]).                             |
------------------------------------
                  |
                  NO
                  |
------------------------------------
| Replace antenna [31].              |
------------------------------------
```

Chart 113

	ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF.	
						MAINT. TOPIC	WIRING DIAGRAM
R	[1] VOR/ILS/DME Control Unit No.1		5-211	1R28	FLT CPT	34-55-13 R/I	34-36-01
R	[2] VOR/ILS/DME Control Unit No.2		5-211	2R28	FLT CPT	34-55-13 R/I	34-36-01
R	[3] Captain HSI		2-211	1F22	FLT CPT	34-23-11 R/I	34-36-02
R	[4] 1st Off HSI		2-212	2F22	FLT CPT	34-23-11 R/I	34-36-02
R	[5] Captain ADI		2-211	1F23	FLT CPT	34-23-12 R/I	34-36-01
R	[6] 1st Off ADI		2-212	2F23	FLT CPT	34-23-12 R/I	34-36-01
R R	[7] Relay	DOOR 215DS	7-215	1R35	Electro- nics racks	34-55-32 R/I	34-36-01
R R	[8] Relay	DOOR 216ES	5-216	2R35	Electro- nics racks	34-55-32 R/I	34-36-01
	[9] Circuit breaker		1-213	1R38	Map Ref. G14	24-50-00 R/I	34-36-01
	[10] Circuit breaker		15-216	2R38	Map Ref. F21	24-50-00 R/I	34-36-01
R R	[11] ILS No.1 receiver	DOOR 215DS	7-215	1R37	Electro- nics racks	34-36-31 R/I	34-36-01
R R	[12] ILS No.2 receiver	DOOR 216ES	5-216	2R37	Electro- nics racks	34-36-31 R/I	34-36-01
R	[13] RAD/INS 1ST PLT SW SUP		1-213	1F26	Map Ref. G17	24-50-00 R/I	34-45-01
R	[14] RAD/INS 2ND PLT SW SUP		15-216	2F26	Map Ref. E21	24-50-00 R/I	34-45-01

	ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
R R	[15] Switch-RAD/INS		5-211	1F25	FLT CPT	34-23-17 R/I	34-55-02
R R	[16] Switch-RAD/INS		5-211	2F25	FLT CPT	34-23-17 R/I	34-55-02
R R	[17] Switch-RAD/INS&VOR/ILS1-VOR/ILS2-selector	DOOR 215DS	7-215	1F24	Electro-nics racks	34-23-13 R/I	34-55-02
R R	[18] Switch-RAD/INS&VOR/ILS1-VOR/ILS2-selector	DOOR 216ES	5-216	2F24	Electro-nics racks	34-23-13 R/I	34-55-02
R	[19] DEV1&DEV2 1ST PLT SW SUP		1-213	1R38	Map Ref G 14	24-50-00 R/I	34-55-02
R	[20] DEV1&DEV2 2ND PLT SW SUP		15-216	2R38	Map Ref 2F21	24-50-00 R/I	34-55-02
R R	[21] Coaxial relay-VOR/LOC No.1	DOOR 215DS	7-215	1R31	Electro-nics racks	34-55-32 R/I	34-36-01
R R	[22] Coaxial relay-VOR/LOC No.2	DOOR 216ES	5-216	2R31	Electro-nics racks	34-55-32 R/I	34-36-01
R R	[23] Switch-DEV1/DEV2 selector		2-211	1R26	FLT CPT	34-55-14 R/I	34-36-01
R R	[24] Switch-DEV2/DEV1 selector		2-212	2R26	FLT CPT	34-55-14 R/I	34-36-01
R R	[25] ILS VHF NAV1 SUP		2-213	1R25	Map Ref G 6	24-50-00 R/I	34-36-01
R R	[26] ILS VHF NAV2 SUP		13-216	2R25	Map Ref E 15	24-50-00 R/I	34-36-01

	ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
R R	[27] Coupler No.1	DOOR 323QR	323	1R198	Fin	34-55-00 I/C	34-36-01
R R	[28] Coupler No.2	DOOR 323QR	323	2R198	Fin	34-55-00 I/C	34-36-01
	[29] Antenna-VOR/LOC No.1		323	1R29	Fin	34-55-11 R/I	34-36-01
	[30] Antenna-VOR/LOC No.2		323	2R29	Fin	34-55-11 R/I	34-36-01
	[31] Antenna-VHF/GLIDE		132	2R16	Under fuselage	23-21-18 R/I	34-36-01

Component Identification
Table 101

INSTRUMENT LANDING SYSTEM (ILS) - MAINTENANCE PRACTICES

1. Cat 3 Autoland

In order to obtain maximum utilisation of the CAT 3 capability the ILS must be maintained in a fully serviceable condition.

Unless maintenance action can positively be identified as curing a defect, the Autoland system must be downgraded. The CAA require that in the event of any ILS malfunction or reported defect, the Radio Supervisor must liase with the appropiate Instrument Supervisor who will down grade the system as necessary.

For full information on Autoland Regrading procedures, refer to Maintenance Manual 22-00-00 (Maintenance Practices).

1. Operational Test

NOTE : This test can be carried out in the hangar providing no disturbing fields are present.

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing)

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

(3) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
DEV 1 & 2 1ST PLT SW SUP	1-213	1R	38	G14
ATT/INS 1ST PLT SW SUP		1F	13	G16
RAD/INS 1ST PLT SW SUP		1F	26	G17
No.1 INPH SUP		R	89	K19
INS COMPTR SUP 2	2-213	F	3	A 6
HSI TRUE 1ST PLT INST SUP & IND		1F	21	B 6
ADI 1ST PLT INS 1 SUP & IND		1F	15	B 7
HSI MAG 1ST PLT INS 1 SUP & IND		1F	16	B 8
ILS VHF NAV 1 SUP		1R	25	G 6
FLT CONT & NAV BUS 14XS		X	355	H 2
No. 2 INPH SUP	3-213	R	90	H 2
INS COMPTR SUP 3	13-216	F	2	B15
ADI 2ND PLT INS 1 SUP & IND		2F	15	C13

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
HSI MAG 2ND PLT		2F 16	C14
HSI TRUE 2ND PLT INS 2 SUP & IND		2F 21	C15
ILS VHF NAV 2 SUP		2R 25	E15
NAV INST BUS 13XS		X 345	G 4
CTR DASH & G/SHIELD INST LTS SUP	14-216	L 375	D10
ATT/INS 2ND PLT SW SUP	15-216	2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV 1 & 2 2ND PLT SW SUP		2R 38	F21

(4) On panel 5-211, make certain that function selector switches on Captain and First Officer VOR/ILS/DME control panels are in STBY position.

(5) Using GLARESHIELD LIGHTING INST LIGHTS selector switch (panel 4-211) check that that control panel illumination can be varied.

(6) Check of VOR/ILS1 - VOR/ILS2 switching units. On Captain and First Officer instrument panel, place switches DEV 1/DEV 2 in DEV 1 position.

(7) On panel 5-211 place both RAD-INS switches in RAD position.

(8) On AP control box by means of VOR-LOC-REF knob position Captain and First Officer HSI track pointers at zero, at top of indicators. Make certain that no mode is engaged.

C. ILS Test

(1) System 1

(a) On Captain control panel, select a LOC frequency on which no signal is received.

(b) Check on HSI indicators :

NAV and G/S flags appear.
GLIDE pointer is effaced.
LOC lateral deviation bar is centered.

1 and RAD indicators are visible.
TO and FROM arrows are effaced.

(c) Place and hold test selector switch on Captain VOR/ILS/DME control panel in UP/L position.

(d) Check procedure of sequences in following table :

SEQUENCES	ON BOTH ADI	ON BOTH HSI
Initial	G/S and LOC flags visible LOC and GLIDE pointers retracted	NAV and G/S flags visible. Lateral deviation bar centered GLIDE pointer retracted
First (after six seconds)	LOC and GLIDE retracted LOC LC pointer at LH stop. G/S pointer displaced one point upwards (Reminder, ± 0.5 V (37.5 microamperes)	Flags retracted lateral deviation bar displaced one point to left (Reminder, ± 1 V (75 microamperes). G/S pointer displaced one point upwards. (Reminder, ± 1 V (75 microamperes)
Second (after twelve seconds)	Flags reappear LOC and GLIDE pointers are retracted	NAV and G/S flags reappear. GLIDE pointer retracts. Lateral deviation bar centres.

(e) Release TEST selector switch (Automatic return to centre position).

- Initial indications reappear on both ADI and HSI.

(f) Place and hold TEST selector switch on control panel in DN/R position then repeat checks in preceding table taking into account that GLIDE pointer is displaced downwards and LOC deviation bar to right.

(g) Release TEST selector switch.
- Initial indications reappear on ADI and HSI.

(i) On Captain and First Officer instrument panels place DEV1-DEV2 switches in DEV2 position.

(2) System 2

(a) Repeat test described in 1. C. (1) above, with First Officer control panel.

(3) Check of audio reception on the two receivers.

(a) On Captain and First Officer jack panel, connect a headset to BOOM SET jack.

(b) On Captain and First Officer audio selector panels, engage reception selection push-buttons VOR/ILS/DME 1 and 2, turn volume control to maximum.

(c) On each control panel select a local frequency signal and check audio signal in headset.

D. Close-Up

(1) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(2) On Captain and First Officer audio selector panel, release VOR/ILS/DME reception selection push-button, return volume control to minimum.

(3) Remove headset from Captain and First Officer jack panels if necessary.

(4) Switch off electronics rack ventilation system (Ref. 21-21-00).

(5) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

NOTE : This test can be carried out in the hangar providing that no disturbing fields are present.

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
VOR/ILS Ground Test Unit (COSSOR or equivalent)	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics rack ventilation system. (Ref. 21-21-00).

(3) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DEV 1 & 2 1ST PLT SW SUP	1-213	1R 38	G14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
No.1 INPH SUP		R 89	K19
INS COMPTR SUP 2	2-213	F 3	A 6
HSI TRUE 1ST PLT INST SUP & IND		1F 21	B 6
ADI 1ST PLT INS1 SUP & IND		1F 15	B 7
ILS VHF NAV 1 SUP		1R 25	G 6
FLT CONT & NAV BUS 14XS		X 355	H 2
No. 2 INPH SUP	3-213	R 90	H 2
INS COMPTR SUP 3	13-216	F 2	B15
ADI 2ND PLT INS1 SUP & IND		2F 15	C13
HSI MAG 2ND PLT		2F 16	C14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
ILS VHF NAV 2 SUP		2R 25	E15
NAV INST BUS 13XS		X 345	G 4
CTR DASH & G/SHIELD INST LTS SUP	14-216	L 375	D10
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV/1 & 2 2ND PLT SW SUP		2R 38	F21

(4) On panel 5-211 make certain that function selector switches on Captain and First Officer VOR/ILS/DME control panels are in STBY position.

(5) Using GLARESHIELD LIGHTING INST LIGHTS, (panel 4-211), check that control panel illumination can be varied.

(6) Check of VOR/ILS1 - VOR/ILS2 switching units. On Captain and First Officer instrument panels place switches DEV 1/DEV 2 in DEV 1 position.

(7) On panel 5-211 place both RAD-INS switches in RAD position.

(8) On AP control box by means of VOR-LOC-REF knob position Captain and First Officer HSI track pointers at zero, at top of indicators. Make certain that no mode is engaged.

(9) On Captain and First Officer jack panel, connect a headset to BOOM SET jack.

(10) On Captain and First Officer audio selector panels, release reception selection push-buttons VOR/ILS/DME 1 and 2, turn volume control to maximum.

(11) Place VOR/ILS ground test unit in flight compartment.

C. ILS Test

(1) System 1

(a) On ground test unit select a LOCALISER/GLIDE

paired frequency, do not select modulation, switch to LOCALISER function.

(b) On Captain control panel select same localiser frequency.

(c) On both HSI

- NAV flag disappears
- Lateral deviation bar centers
- G/S flag is visible
- GLIDE pointer disappears
- Annunciators 1 and RAD are visible
- TO and FROM arrows are effaced.

On both ADI

- LOC flag is retracted
- LOC pointer centers
- G/S flag is visible
- GLIDE pointer disappears

(d) On the ground test unit, select a modulation of 4 dB, then 6.6 dB to the right :

On both HSI
- Lateral deviation bar is displaced to the right.

On both ADI
- LOC pointer is displaced to the right.

(e) On the ground test unit, select modulation of 4 dB, then 6.6 dB to the left.

On both HSI
- Lateral deviation bar is displaced to the left.

On both ADI
- LOC pointer is displaced to the left.

(f) On ground test unit, place modulation at zero, check that on both HSI, lateral deviation bar is recentered, that on both ADI, LOC pointer is recentered.

On the ground test unit, vary deflection to the right until 180 microamperes is indicated.

On both HSI and ADI, lateral deviation bar deviates proportionally to the right, LOC pointer deviates right.

(g) On the ground test unit, vary deflection to the left until 180 microamperes is indicated.

On both HSI and ADI, lateral deviation bar deviates proportionally to the left, LOC pointer deviates left.

(h) On the ground test unit, return variable deflection control to zero. Switch to GLIDE function.

(i) On both HSI

- NAV flag appears, GLIDE flag disappears
- GLIDE pointer is positioned at mid scale.

On both ADI
- LOC flag appears, GLIDE flag disappears.
- LOC pointer is retracted, GLIDE pointer centers.

(j) On the ground test unit, select modulation of 2 dB, then 3.76 dB downwards.

- GLIDE pointer deviates downwards on both HSI and ADI.

(k) On the ground test unit, select identical modulation upwards.

- GLIDE pointer deviates upwards on both HSI and ADI.

(l) On the ground test unit, return modulation to zero, check on both HSI and ADI that GLIDE pointer is recentered.

(m) On the ground test unit vary deflection downwards until 120 microamperes is indicated.

- On both HSI and ADI, GLIDE pointer deviates downwards.

(n) On the ground test unit vary deflection upwards until 120 microamperes is indicated.

- On both HSI and ADI GLIDE pointer deviates upwards.

(o) On the ground test unit place variable deflection control in zero position, GLIDE pointers recenter on HSI and ADI.

(p) Place DEV 1/DEV 2 switch in DEV 2 position.

(2) System 2

(a) Repeat test described in System 1 paragraph, using First Officer control panel.

(b) Select a local frequency on each control panel separately, and check for audio signal in headset. If this is not possible actuate TONE signal on ground test unit to carry out audio signal check.

D. Close-Up

(1) Switch off ground test unit, remove if necessary.

(2) Switch off electronics rack ventilation system. (Ref. 21-21-00).

(3) On Captain and First Officer audio selector panels engage VOR/ILS/DME reception selection push-button, return volume control to minimum.

(4) Remove headsets from Captain and First Officer jacks if necessary.

(5) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(6) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

3. System Test

NOTE : This test can be carried out in a hangar providing that no disturbing fields are present.

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
VOR/ILS Ground Test Unit (COSSOR or Equivalent)	
SWR Meter (Ferisol or Equivalent)	
Cable for SWR Measurement	

B. Prepare

Repeat Prepare procedure in functional test, ref. paragraph 2-B.

C. Tests

Repeat Test procedure in functional test, ref. paragraph 2-C.

D. SWR Measurement

(1) Prepare

(a) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ILS VHF NAV 1 SUP	2-213	1R 25	G 6
ILS VHF NAV 2 SUP	13-216	2R 25	E15

R (b) Remove ILS 1 and 2 receivers, from shelves 7-215
R and 5-216 respectively.

R (c) On Captain and First Officer VOR/ILS/DME control
R panels select a LOCALIZER frequency.

(2) SWR Measurement

(a) ILS 1 antennas

R (a1) Shelf 7-215, connect SWR meter by means of cable to terminal A1 on connector 1R37AA (LOC 1 antenna)

(a2) Measure and note SWR value on a frequency of 11.5 MHz. SWR must be maximum 5.

(a3) Disconnect SWR meter, and connect by means of cable to terminal A2 on connector 1R37AA (GLIDE 2 antenna).

(a4) Measure and note SWR value on a frequency of 330 MHz. SWR must be maximum 5.

(a5) Disconnect SWR meter, install ILS 1 receiver

(b) ILS 2 antennas

R (b1) Shelf 5-216, connect SWR meter by means of cable to terminal A1 on connector 2R37AA (LOC 2 antenna).

(b2) Measure and note SWR value on a frequency of 110.5 MHz. SWR ratio must be maximum 5.

(b3) Disconnect SWR meter, and connect by means of cable to terminal A2 on connector 2R37AA (GLIDE 2 antenna).

(b4) Measure and note SWR value on a frequency of 330 MHz. SWR must be maximum 5.

(b5) Disconnect SWR meter, install ILS 2 receiver

E. Close-Up

(1) Reset circuit breakers previously tripped in paragraph 3-D-(1)-(d).

(2) Carry out Close-Up procedure in functional test Ref. paragraph 2-D.

ILS RECEIVERS 1R37 & 2R37 - REMOVAL/INSTALLATION

1. General

ILS1 receiver 1R37 is installed on shelf 7-215.
ILS2 receiver 2R37 is installed on shelf 5-216.

2. Removal/Installation

As the ILS receivers are identical, removal/installation of ILS1 receiver 1R37 only will be described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Ventilation Outlet Blanking Plate	

B. Prepare

(1) Remove panel DS from shelf 7-215 (panel ES from shelf 5-216 for receiver 2R37).

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DEV1S DEV2 1ST PLT SW SUP	1-213	1R 38	G14
ILS UHFNAV1 SUP	2-213	1R 25	G 6
ILS VHFNAV2 SUP	13-216	2R 25	E15
DEV1 & DEV2 2ND PLT SW SUP	15-216	2R 38	F21

(3) On panel 5-211, make certain that S/B-DME-OVRD function selectors on Captain and First Officer VOR-ILS-DME control units are in S/B position.

C. Remove ILS1 Receiver

(1) Gain access to shelf 7-215 (shelf 7-216 for receiver 2R).

(2) Refer to 34-00-00, Removal/Installation, paragraph 2. D.(1).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2. E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2. F.(1).

F. Tests

(1) Carry out a test of ILS receiver installed.

(2) Carry out an ILS test (Ref. 34-36-00, Adjustment/Test, Operational Test).

G. Close-Up

(1) Install panel DS on shelf 7-215 (panel ES on shelf 5-216 for receiver 2R24).

VHF2/GLIDE ANTENNA - REMOVAL/INSTALLATION

1. General

This topic covers removal/installation procedure following antenna replacement or check.
As the antenna is common to both the VHF2 system and the ILS systems, any work carried out on either part of the antenna requires its removal or replacement, even when it is operating correctly in one of the two functions.

2. Removal/Installation

Refer to Chapter 23-21-18, Removal/Installation.

INDEPENDENT POSITION DETERMINING - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

Independent position determining encompasses the following systems: weather radar, radio altimeter, inertial navigation system (INS) and the inertial signals comparator unit (ISCU). The feature of these systems is that they do not depend on a ground infrastructure.

R

The TCAS function is independent of Ground Systems.

2. Weather Radar Systems

Consisting of two independent installations except for the antenna radiator, this electronic equipment collects continuous information on the position and turbulence of cloud formations. In mapping mode it also maps a sector of the terrain ahead of the aircraft. These two types of information are obtained from the radar antenna scan referenced to the aircraft axes by INS gyro-stabilization. The radar scans a sector of the terrain ahead of and below the aircraft. This X band radar beam generated by the radar transmitter is analysed in the receiver and displayed on two cathode ray tube screens which provide the Captain and 1st Officer with either cloud formation density information or a map showing gound contours and features. Markers and a range of scales on the screens enable distances to be measured.

3. Radio Altimeter Systems

The aircraft is equipped with two independent installations. This electronic equipment supplies altitude data for the automatic pilot systems and for low altitude flight. (All weather landing system (AWLS) and low altitude flight system (LAFS)).
The radio altimeter system operates in the S band and indicates altitude on two indicators, in two ranges from zero to 2500 ft. A decision height selected in landing mode is available by the use of an indicator light on the altitude indicators. Altitude measurement is based on the principle of time difference measurement between the transmitter signal and the ground reflected signal.
Automatic calibration and a monitoring system guarantee precision and reliability.

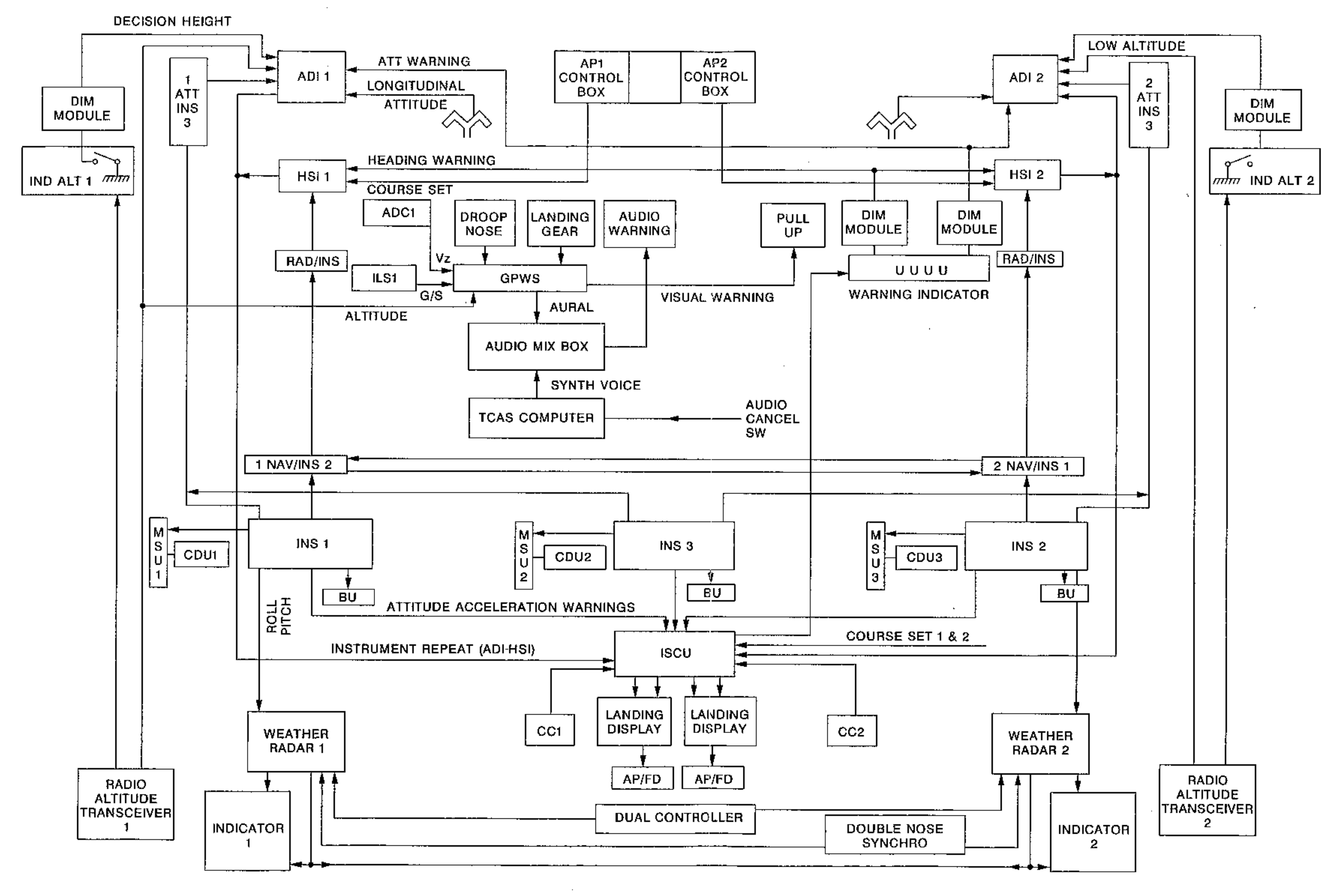
R

Radio Altimeter information is transmitted to TCAS computer (Ref. 34-43-00).

4. Inertial Navigation Systems

The aircraft is equipped with three independent installations, this electronic device uses the laws of inertia and enables navigation without external aids. An inertial platform stablised in 3 axes, by 2 gyroscopes with 2 degrees of freedom acts as a support for 3 accelerometers. This method enables stable orientation to be maintained in space and to evaluate platform heading pitch, roll and acceleration parameters. These are processed by a computer and its peripherals enabling, from a departure waypoint, determination and following of a track, continuous position, drift and attitude (pitch and roll) information, as well as wind speed and direction, groundspeed and distance - time to go. This information is sent to the Control Display Unit (CDU) in which the flight parameters can be inserted by the Pilot. The Horizontal Situation Indicator (HSI) and Attitude Director Indicator (ADI) provide the means of information presentation and monitoring. The INS sends desired track and monitor warning information to the automatic pilot/flight director (AP/FD).

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R

System Block Diagram
Figure 001

5. Inertial Signals Comparator Unit (ISCU)

The ISCU monitors information supplied by the three INS, the two HSI, the two ADI, the two compass couplers and the two COURSE SET selectors on the AP/FD (C1) control boxes. This monitoring is based on information comparison according to thresholds established by the mode of operation, cruise or approach mode. The unit authorises aircraft automatic landing, category IIIA. Fault indications as well as AP/FD disconnections, and landing display warnings are indicated by illumination of lights on the warning indicator unit and for certain conditions repeated by rotation 90° of dive of the ADI drum corresponding to the fault channel.

R Inertial Navigation INS1 and Compass Coupler information are transmitted to TCAS Computer (Ref. 34-43-00).

6. Ground Proximity Warning System (GPWS)

The ground proximity warning system is a device which improves flight safety by means of visual warnings on the instrument panel and aural warnings which sound in the audio warning system loudspeakers when the following flight conditions occur:

- Excessive rate of descent with respect to terrain
- Excessive closure rate with terrain
- Loss of altitude after take-off or go-around
- Approach with aircraft not in landing configuration (droop nose or landing gear)
- Excessive deviation below the glideslope.

R The GPWS supplies information to the TCAS Computer through the audio mixing box.

7. TCAS System

R The TCAS II system consists of a computer associated with an ATC/Mode S transponder. It permits display on the Captain's
R and Co-pilot's TCAS vertical speed indicators of conventional vertical speed information and, at the same time, intruder location and avoidance manoeuvre indications.

The TCAS computer ensures two main functions:

- a transmission/reception function for intruder acquisition
- a processing function ensuring intruder trajectory computation and tracking.

Associated aural alerts are generated on the audio warning system via an audio mixing box associated with the GPWS (Ref. 34-43-00).

WEATHER RADAR RDR-4B - DESCRIPTION AND OPERATION

1. General

The weather radar system presents the pilots with a topographic map type of display of moisture laden weather formations (WX) or major terrain features such as rivers, coastlines, major mountain peaks, and cities for position fixing (MAP). The weather displays permit the pilot to avoid storm penetration and the associated turbulence.

The weather radar system consists of two identical systems, only one of which operate at one time. The system consists of dual receiver/transmitter (RX/TX) units (1S23 and 2S23), captain's indicator (1S28), first officer's indicator (2S28), a control panel (S24), waveguide, waveguide switch (S29) and an antenna assembly (S25) (Ref. Fig.1, sheets 1, 2, 3 and 4). The waveguide switch connects the selected RX/TX to the antenna through the waveguide. The antenna is a flat plate array radiating antenna with two identical drive systems. Stabilization of the antenna in pitch and roll for line of sight scanning is provided by the inertial navigation system (INS) (1F8 and 2F8) and the nose droop compensation signal is derived from the nose droop synchro (M58).

Two identical RX/TX are installed on shelf 29-123 in the weather radar bay as shown in Fig.1, sheets 1 and 2. Access to the transceivers is gained through door 123 AB. The RX/TX generates and transmits high energy radio frequency (RF) pulses at a nominal frequency of 9345 MHz, X-band which are radiated by the antenna. A small portion of the radiated energy is reflected back to the aircraft by moisture laden clouds or by major terrain features and has a penetration range through relatively light intervening rainfall to detect distant rainfall storm areas at ranges of up to 320 miles. The reflected signals are received by the same antenna, processed by the RX/TX unit and displayed on the indicator. The transfer of the RF energy between the RX/TX unit and the antenna takes place via the waveguide. For the ranges of 0 to 40 miles, the weather data is processed to determine the velocity distribution of precipitation returns to verify there is turbulence.

The captain and first officer indicators are located on the side consoles adjacent to each pilot (See Fig.1, sheet 4) and have digital memory, video brightness (BRT) controls and a display range selector with a Standby position. The single control panel is located on the centre console and controls operation of the weather radar, enabling RX/TX system selection, mode selection, system self-test, receiver sensitivity adjustment (GAIN) and tilt angle selection.

The weather radar system has a built-in operator-actuated test pattern for fault identification. The operator-actuated test causes the injection of test signals, which are used to generate a test pattern on the indicator without transmitting, allowing the operator to adjust the display and to ascertain correct operation of all system components.

Concorde has been retrofitted with the Allied Signal RDR-4B WX ARINC 708A Radar System by EOC-CON-034G286. This new low power radar is different from the old high power Honeywell AVQ-30X WX Radar System ARINC 564 architecture in a number of respects as detailed below.

A. In order to accommodate an RDR-4B retrofit, whilst still utilizing most of the existing AVQ-30X system wiring, Allied Signal designed a RX/TX mounting tray which has interface wiring which converts the system to the 708A standard. However, some relocation of wires was required on the aircraft at the connectors for the antenna drive, display units and the control panel.

B. All existing AVQ-30X WX Radar System LRUs were replaced with RDR-4B units. Receiver/Transmitters type RTA-4B, Indicators type PPI-4B, Control Panel type CON-4B, Antenna Drive type DAA-4A, Antenna type REA-4B and RX/TX Mount type MBA-4B.

C. The functions provided by the Allied Signal RDR-4B system are similar to the AVQ-30X but with the auxiliary facility of Turbulence Detection provided by the new system. Although the RDR-4B system is capable of windshear detection and warning, this functionality is not implemented due to the low transmissivity (Class E status) of the Nose Radome.

D. Unlike the AVQ-30X radar, the RDR-4B system does not require any warm up time and will start transmitting as soon as WX, MAP or WX/TURB radar modes are selected.

E. One facility that the AVQ-30X system had which is not available with the RDR-4B System is the attention getting radar alert light which came on when a large echo was detected directly in front of the aircraft. However, this facility was rarely used by crews and the radar alert circuitry has been fully deactivated. The alert lights are still present on the front dash panels as they are part of another assembly, but the wiring to the weather radar transceivers has been disconnected.

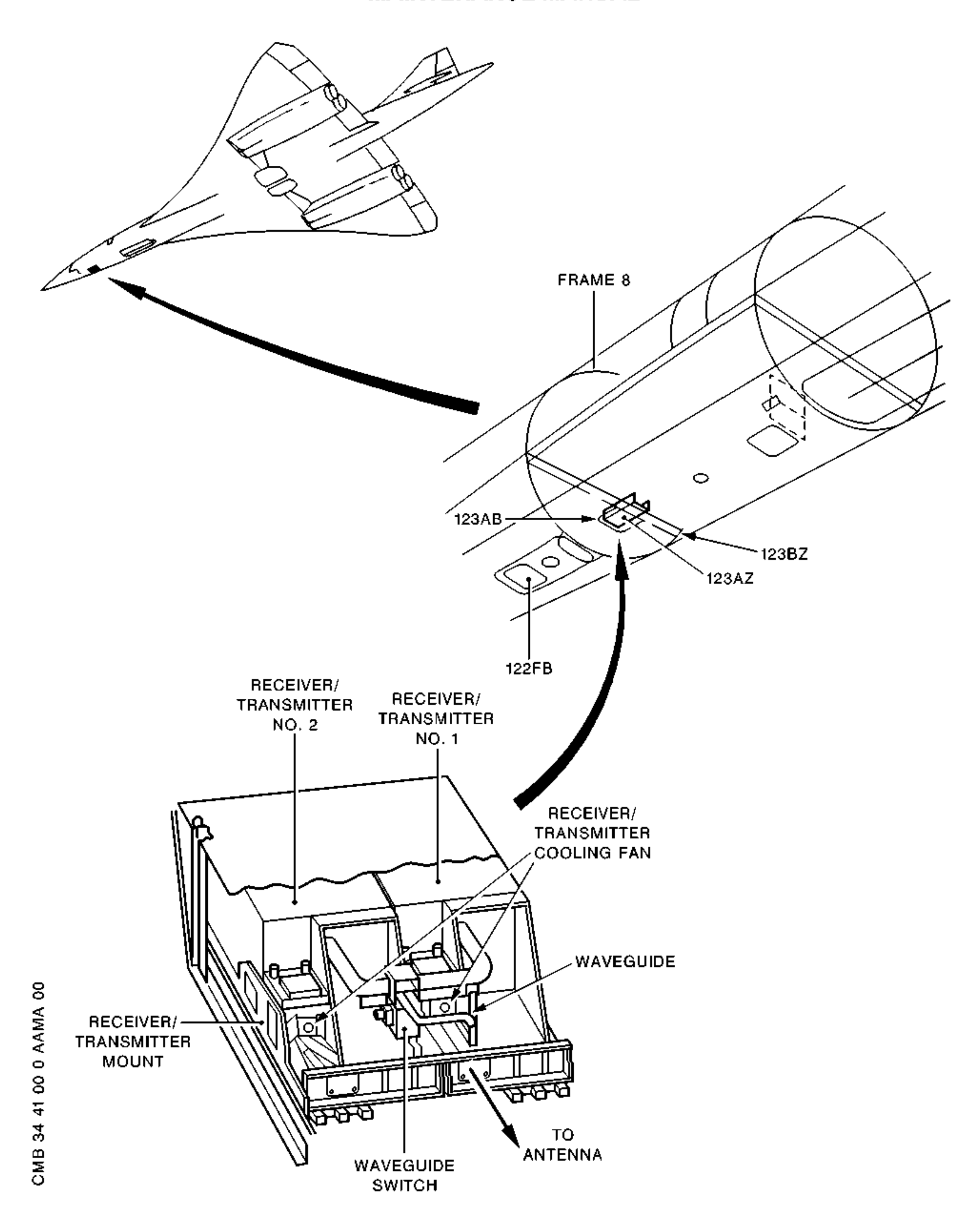
F. The RDR-4B uses line-of-sight stabilization. It does not have independent roll axis stabilization as did the old AVQ-30X radar. The roll axis stabilization on the RDR-4B system is combined with the pitch stabilization in the elevation control for compensation of all roll and pitch. The interface of the weather radar with other systems such as the INS and nose droop synchro is shown in Fig.2. The X and Y outputs from the nose droop position synchro are used as the nose position input to the RX/TX. This signal has a scale factor of 200 mV/degree as defined by ARINC 564. The nose droop information is combined with the pitch input by the two-wire pitch buffer amplifier in the RX/TX. Scaling resistors are installed on the MBA-4B mounting tray to reduce the nose droop input scale factor to 50 mV/degree to match the RDR-4B two-wire pitch input.

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G. Due to the low power of the RDR-4B radar and the pencil beam shaped ground mapping beam, the maximum detectable ground mapping range is less than that of the AVQ-30X radar.

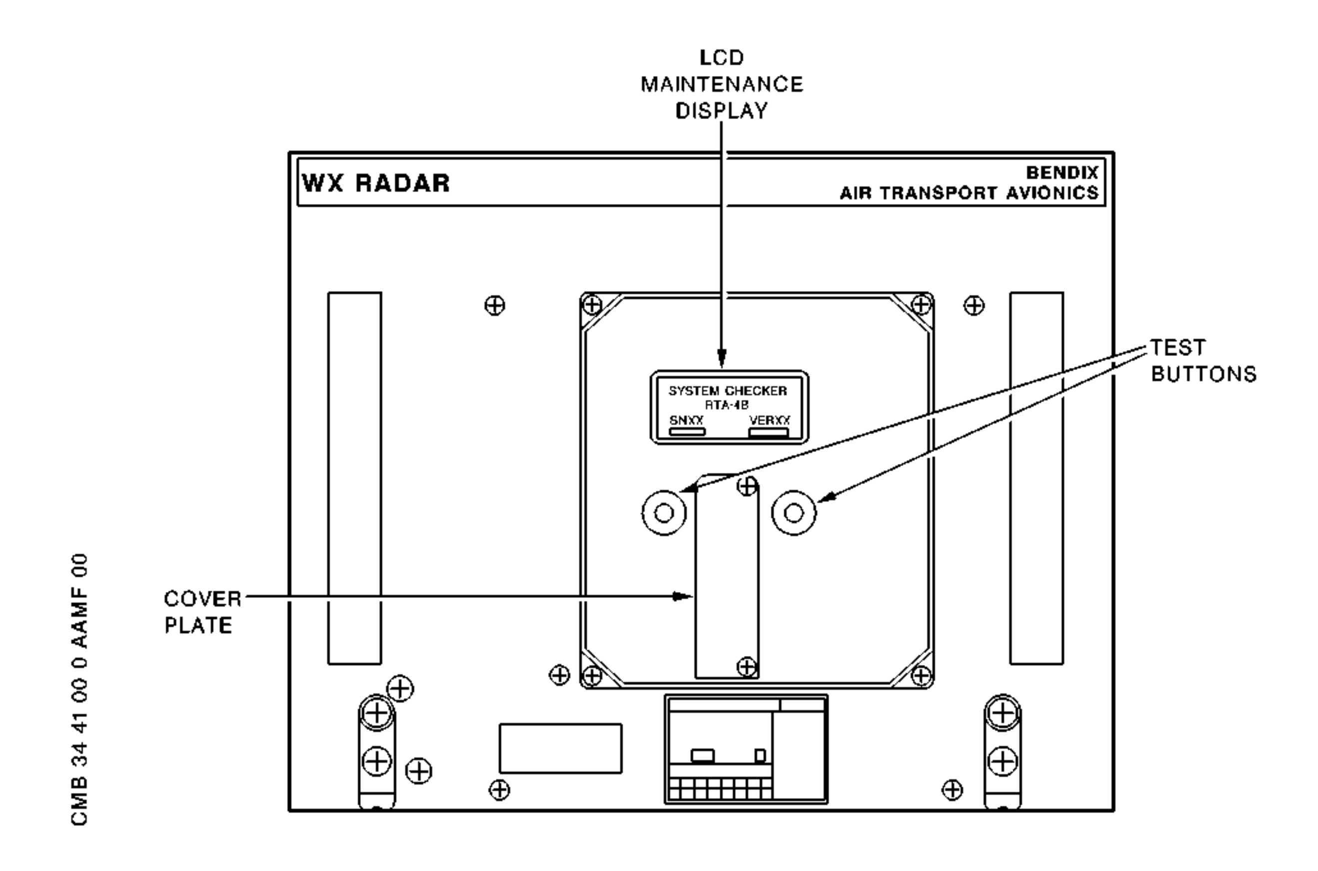
H. The waveguide pressurization system for the AVQ-30X radar was required to prevent arcing in the waveguide due to the high power of the radar. Waveguide pressurization is not necessary with the RDR-4B due to the low power of the radar. However, the pressurization system remains in place and pressure is maintained by a pressure window on the mount and a plastic window within the RDR-4B scanner, which is present on all drive units.

J. Finally, in the RDR-4B retrofit, on shelf 29-123, RX/TX No.1 is more logically located on the left side of the aircraft and RX/TX No.2 is on the right side. The opposite was the case with the AVQ-30X RX/TXs where the cables for each RX/TX crossed over on the shelf.

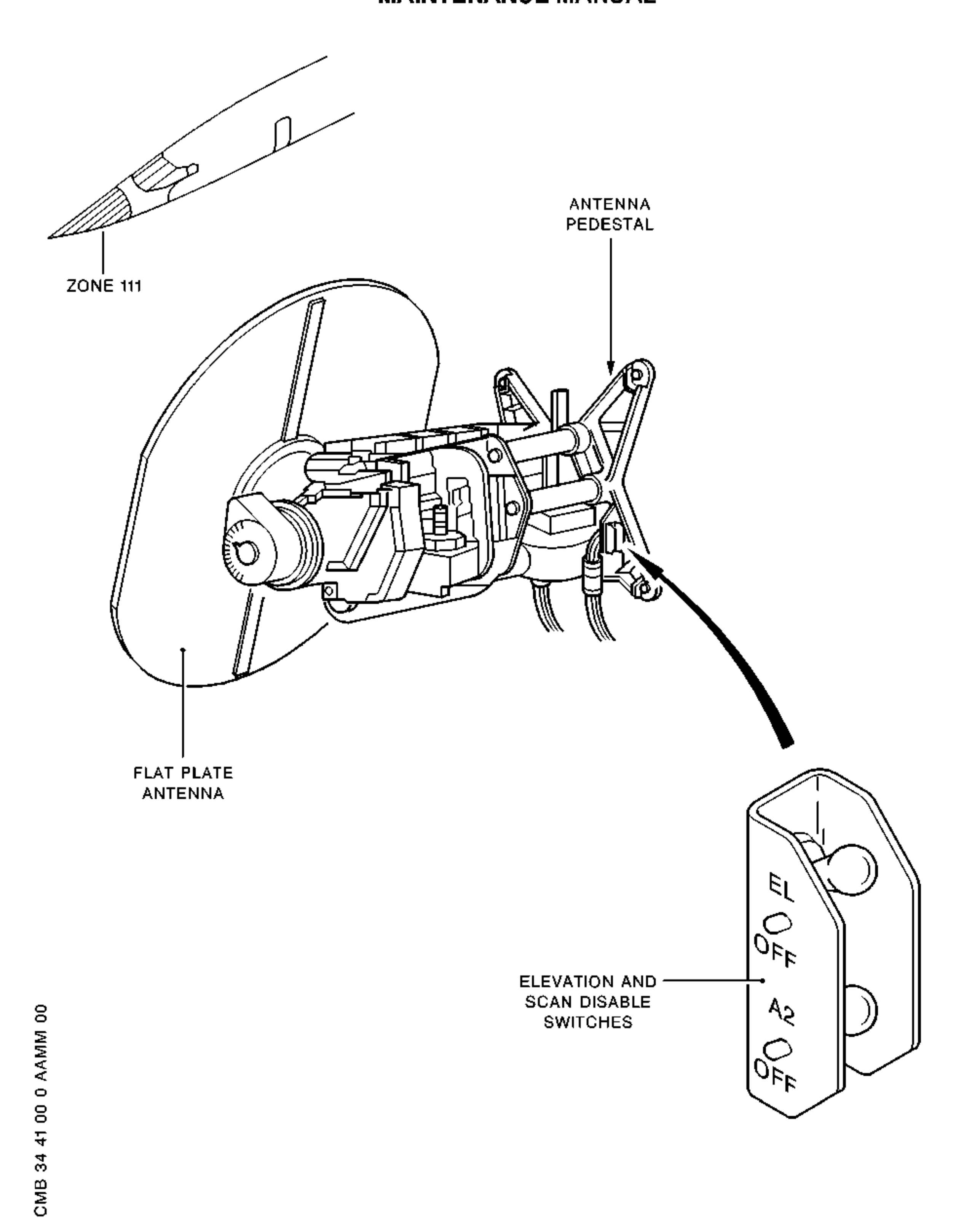


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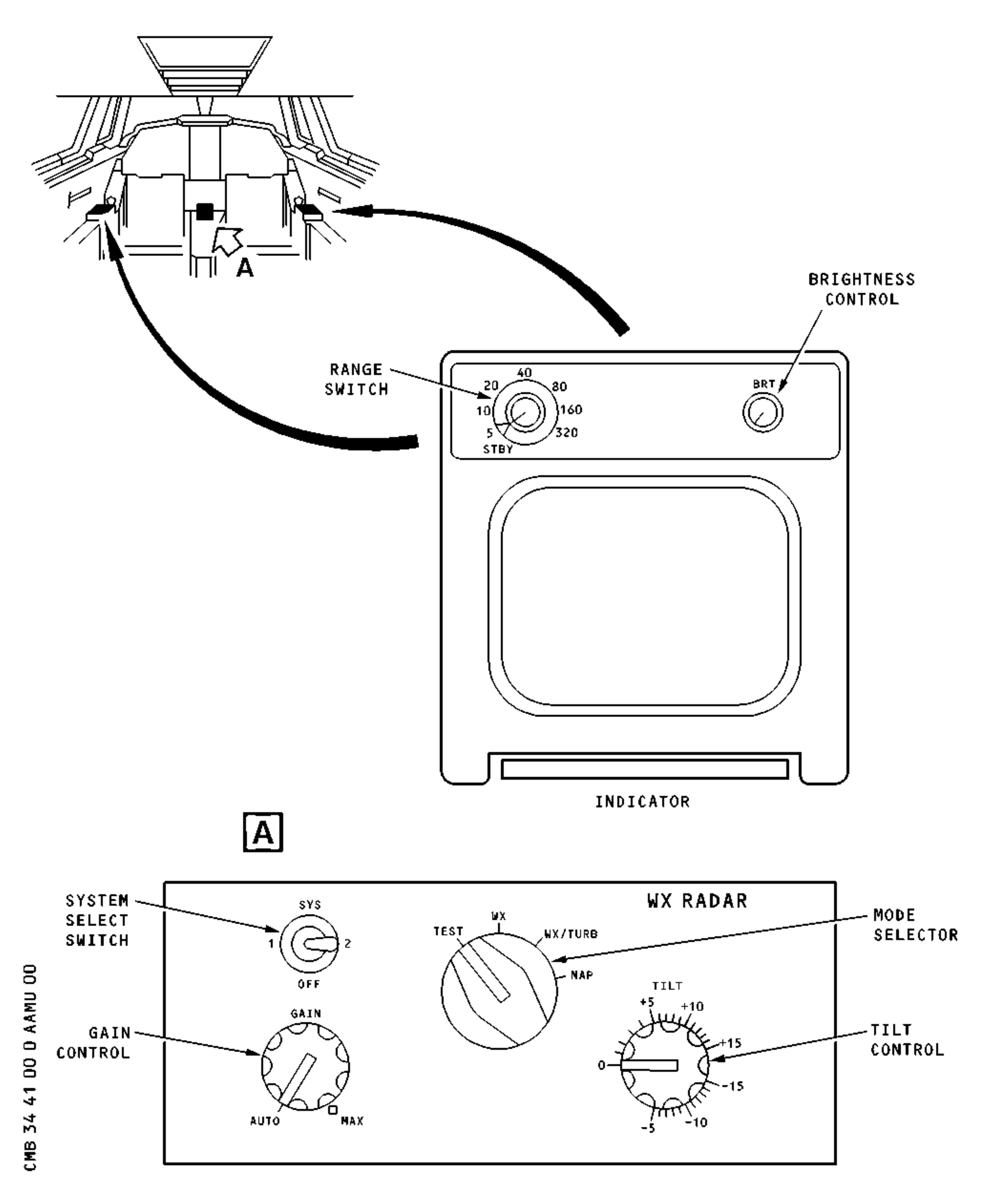
Weather Radar System - Receiver/Transmitters and Mounts
Figure 1 (Sheet 1 of 4)



Weather Radar System - Receiver/Transmitter
Figure 1 (Sheet 2 of 4)



Weather Radar System - Antenna Assembly 1
Figure 1 (Sheet 3 of 4)



Weather Radar System - Indicator and Control Panel
Figure 1 (Sheet 4 of 4)

2. System Breakdown

The following provides a detailed description of the radar system equipment.

A. CON-4B Control Panel Description

CHARACTERISTICS	DESCRIPTION
Power Requirements	+12V dc and +28V dc generated by RTA-4B
Weight	1.9 lb (0.86 kg)
Output	Low speed ARINC 429

(1) The weather radar control panel (S24) is located on the centre console (Ref. Fig.1, sheet 4). There are two plugs on the rear face of the panel that connect to wiring for each of the two radar systems. The control panel provides all the weather radar controls except for the range control and brightness (BRT) control on the indicator. Apart from the control knobs, the circuitry inside the control panel is duplicated for complete dual system redundancy.

(2) Power is supplied to the control unit via each of the RX/TX units.

(3) The system transfer (SYS) switch (lift-to-select operation) allows selection of the No.1 or No.2 system and also controls primary power to the selected system. The OFF position is a Standby position that allows only certain circuits in the transceiver to be active.

(4) The rotary mode selector switch allows selection of TEST, WX, WX/TURB and MAP modes of operation. The SYS switch has to be selected to No.1 or No.2 transceiver, with at least one indicator selected to a range, for the above modes to be operative.

(5) The antenna TILT control provides manual control of the radar antenna elevation and is calibrated in 1 degree increments. The maximum TILT setting is ±15 degrees.

(6) The GAIN control is used to adjust the gain of the receiver in the receiver/transmitter. In the AUTO position, gain is preset to provide optimum operation.

B. PPI-4B Weather Radar Indicator Description

CHARACTERISTICS	DESCRIPTION
Power Requirements	115V ac ±10%, 400 Hz, 0.6 ampere
Weight	15.43 lb (7.0 kg)
Form Factor	ARINC 708 or 708A
Cooling	Convection
Display Size	3.3 x 4.3 in (83.82 x 109.22 mm)
Type of Scan	X-Y raster
Display Storage	Electronic memory - 294,912 bits
Refresh Rate	63 Hz
Range/Range Marks	5/2 & 5, 10/5, 15/5, 20/5, 30/10, 40/10, 60/20, 80/20 or 25, 120/40, 160/40, 180/50, 240/80, 300/50 and 320/80

(1) The PPI-4B Weather Radar Indicators (1S28 and 2S28) are located on the side panels adjacent to each pilot (Ref. Fig.1, sheet 4 and Fig.3). The indicators receive and process the video data contained in an ARINC 453 1600-bit serial word from the active RX/TX unit and presents this information as a continuous display of weather, turbulence or terrain mapping.

(2) The PPI-4B Indicator is a high-resolution colour indicator that provides a constant, non-fading display of all detectable targets within the scan angle and range selected. The indicator contains ARINC 453 interface receivers, azimuth tracking, scan converter and sweep circuits, front panel controls, high and low voltage power supplies, a microprocessor and analogue-to-digital converter. Controls on the indicator select the operation range for the radar and adjust brightness of the display. Digital technology is used to display information on a 5-inch CRT that has a X-Y raster scan. Digital processing enables presentation of several levels of rainfall density by using different colours to represent each level. The rainfall rates and corresponding display colours used in standard ARINC 564 and ARINC 708A displays in the weather mode are displayed in up to four distinct colours - green, yellow, red and, as an option, magenta. The weakest targets are displayed in green and the strongest in either red or magenta. If turbulence detection is selected, areas of moderate to heavy turbulence within a 40 nautical mile range are displayed as magenta. The azimuth range lines, sector and alphanumeric markings are coloured blue.

(3) The indicator rotary range selector switch has positions of STBY (standby) and range in nautical miles of 5-320.

(a) The indicator contains circuitry for generating alphanumeric legends to annunciate selected range (field A), range mark interval (field B), mode of operation (field C), antenna tilt (field D) and fault warnings (fields D, E, F, and G). The Indicator Alphanumeric Display is shown in Fig.3. The different legends are displayed as follows:

- RNG XXX - Selected range is displayed, in blue characters, in the upper left corner of the CRT.
- MRK XX - Range mark interval for selected range is displayed, in blue characters, in the upper right corner of the CRT.
- TEST, WX, TURB or MAP - Selected mode of operation is displayed, in blue characters, directly below the selected range display.
- XX.X () - Amount of antenna tilt selected and direction of tilt, an arrow pointing either up or down, is displayed in blue characters, directly below the range mark interval.
- STAB - is displayed in yellow characters when stabilization input failure occurs.

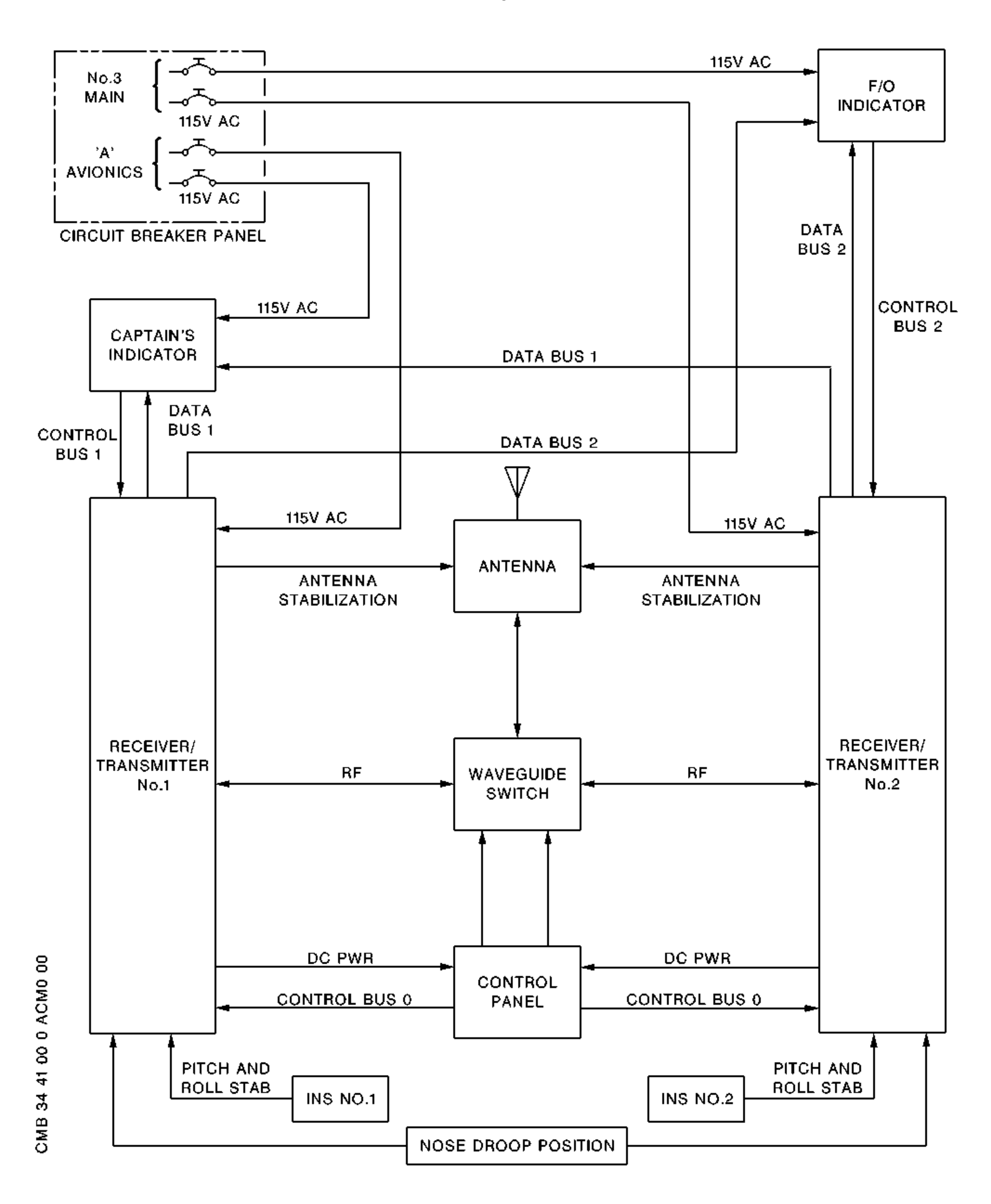
- COOL - is displayed, in yellow characters directly below selected mode, when RX/TX experiences cooling fault.
- CAL - is displayed, in blue characters directly below antenna tilt/STAB, when system GAIN control switch not set to AUTO. Displayed in yellow characters, when RX/TX receiver gain out of calibration.
- XXX FAULT - Displayed, in yellow characters in the middle of the CRT with no other display present (See Fig.4), when TEST is selected and one or more of the following LRU's fail:

  1. R/T FAULT
  2. ANT FAULT
  3. ATT FAULT
  4. IND FAULT
  5. COOL FAULT
  6. CON FAULT

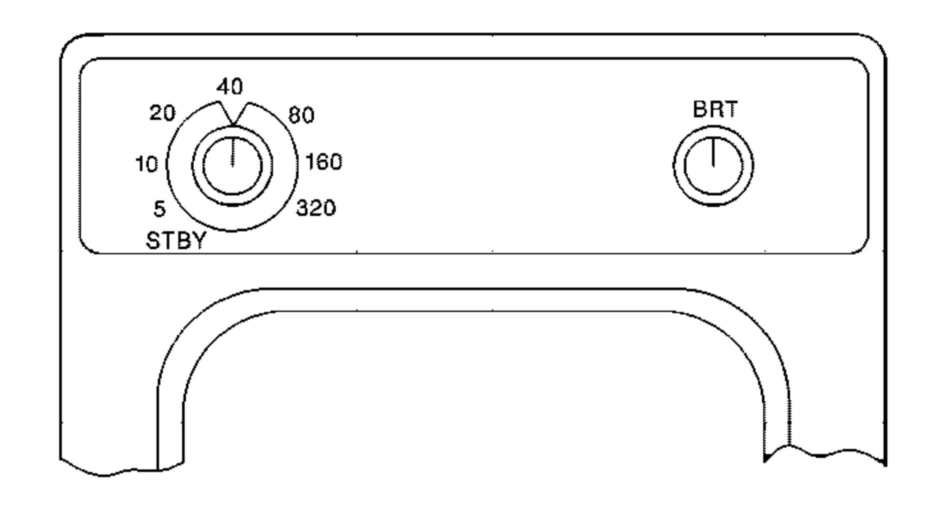
Note: With some transceiver units, if TEST mode is selected and the INUs are not aligned, a nuisance "EXT PWS" fault message is produced and displayed in yellow. This message can be ignored unless it persists after alignment.

- XXX FAULT - is displayed, in yellow characters, when a mode other than TEST is selected and one or more of the following LRUs fail:

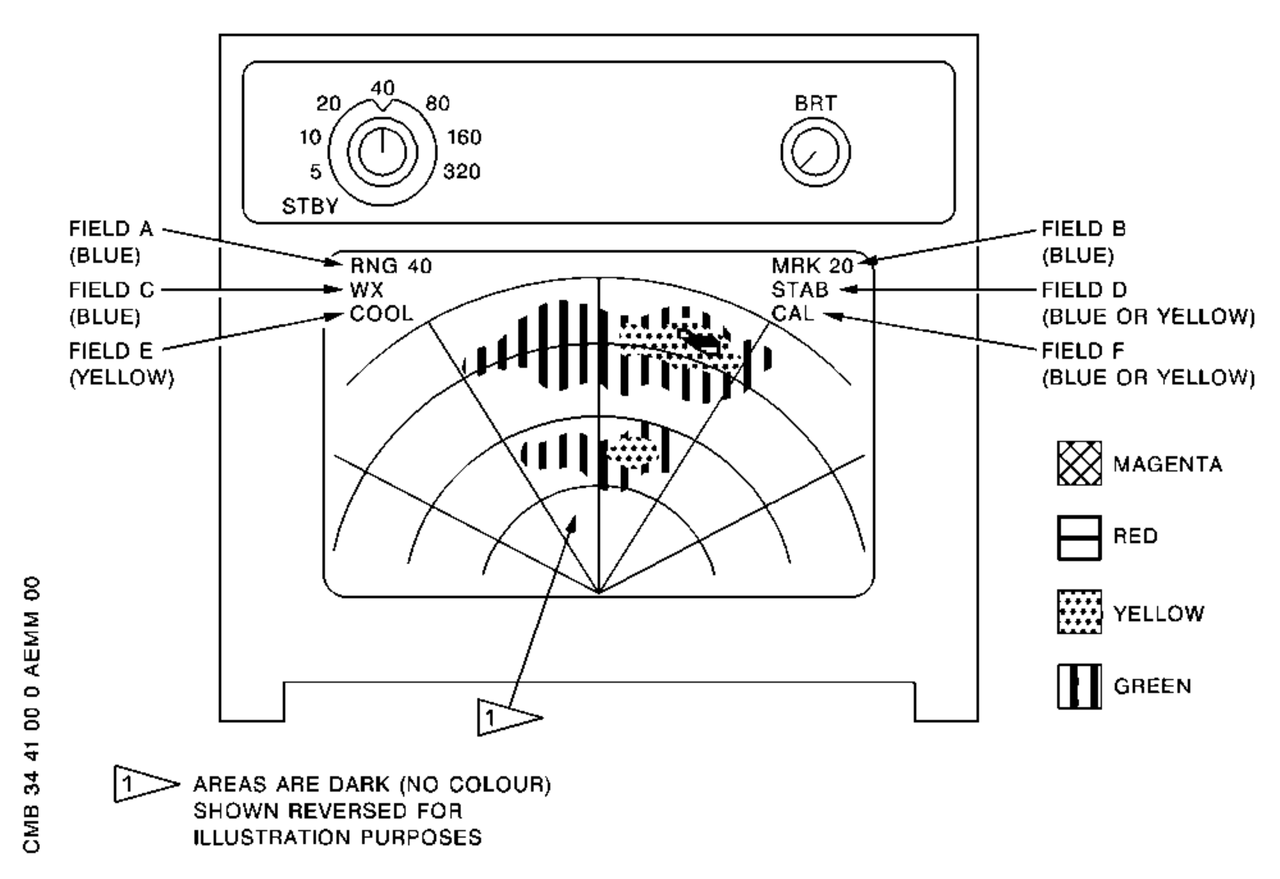
  1. R/T FAULT
  2. ANT FAULT



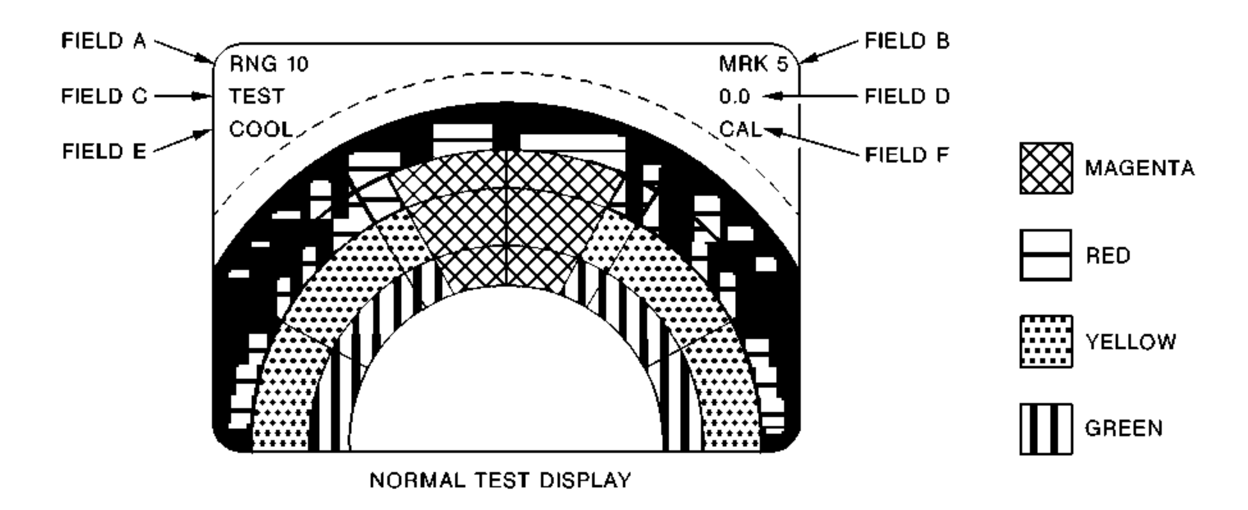
Weather Radar System Block Diagram
Figure 2



Detail of Indicator Controls
Figure 3 (Sheet 1 of 2)

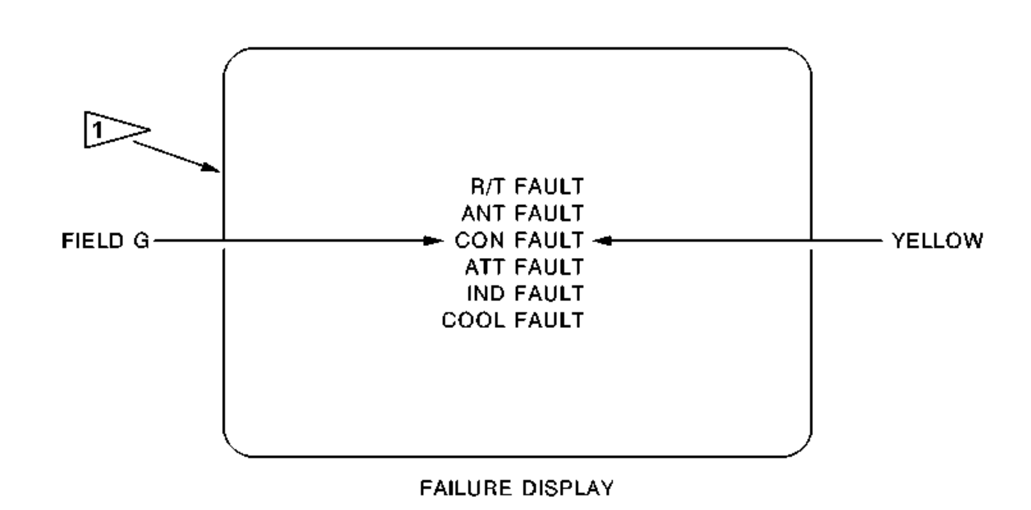


Indicator Alphanumeric Displays
Figure 3 (Sheet 2 of 2)



NORMAL TEST DISPLAY

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FAILURE DISPLAY

CMB 34 41 00 0 AGMD 00

1 AREAS ARE DARK (NO COLOUR) SHOWN REVERSED FOR ILLUSTRATION PURPOSES.

Weather Radar Test and Failure Displays
Figure 4

C. DAA-4A Antenna Drive Assembly

(1) The component parts of the antenna assembly are the DAA-4A Drive Assembly and the 30 inch REA-4B flat-plate array (S25) (Ref. Fig.1, sheet 3). The antenna assembly, located within the aircraft nose cone radome in an unpressurized section of the aircraft, forms the microwave energy into a 3 degree conical-shaped beam that sweeps 90 degrees to the left and 90 degrees to the right of the aircraft centre line. The antenna also receives the same microwave energy, when reflected by weather formations or other objects and routes the signals to the RX/TX for processing.

(2) The previously installed AVQ-30X radar system offered two radiated beam configurations, pencil beam for weather detection and fan-shaped beam for short range ground mapping. The new RDR-4B radar has been optimised for weather avoidance and long range terrain mapping using only a pencil beam. The planar phased array develops the required pencil beam radiation pattern by means of phase reinforcement/cancellation of energy from adjacent slots in the planar array.

(3) The weight of the antenna and drive unit is 30.48 lb (13.83 kg) and power is supplied to the antenna assembly via the RX/TX unit.

(4) The antenna drive receives 115V ac power from the RX/TX. The antenna drive has two sets of power supplies and electronics. One set drives the antenna with the No.1 RX/TX selected. The other set drives the antenna with the No.2 RX/TX selected. Each drive system consists of an azimuth drive motor, an elevation drive motor, an azimuth position synchro, an elevation position synchro, antenna position monitors and scan disable switches.

(5) The antenna assembly scans a 180 degree sector in azimuth and has a tilt (pitch) coverage of ±15 degrees. The horizontal scan stepper motor is used to drive the antenna ±90 degrees of the aircraft centreline. The vertical elevation scan stepper motor is used to drive the antenna ±40 degrees up or down (this includes the manual tilt ± degrees selection from the control panel). Operation of the TILT control, on the control panel, up or down from the zero position impresses a fixed angle on the stabilized/boresight zero position of the antenna planar array. Maximum manual compensating movement of the antenna is 40 degrees for combined pitch and roll plus or minus the TILT angle set at the control panel. Additionally, there are electronic limits of ±42 degrees in the pitch and roll axes that, if exceeded, cause partial loss of stabilization and a blue STAB annunciation on the indicator. Stabilization rate is 20 degrees/second.

(6) There is a zero position monitor and an incremental monitor for each motor. These monitors send antenna horizontal scan and elevation scan position feedback to the RX/TX. There are elevation and azimuth scales on the antenna drive unit that permits a visual measurement of the tilt and scan angles.

(7) The azimuth scan and elevation scan disable switches on the antenna drive are used to permit the removal of power to the scan and elevation stepper motors. These switches are used to inhibit movement of the antenna during maintenance. The switches do not stop RF transmissions from the RX/TX.

D. RTA-4B Receiver-Transmitter - Mechanical Description

CHARACTERISTICS	DESCRIPTION
Power Requirements	115V ac, ±10%, 400 Hz, 1.75 amperes max. including scanner and control panel
Weight	29 lb maximum (13.2 kg)
Transmitter Peak Power Output	125 watts (nominal)
Pulse Width	6 and 8 microseconds (Radar Modes)
Pulse Repetition Rate	380 Hz - Weather and Map Modes 1600 Hz - Turbulence Mode
Operating Mode	Pulse coherent

CHARACTERISTICS	DESCRIPTION
Frequencies	9330 MHz, 9332 MHz, 9335 MHz, 9338 MHz, 9342 MHz, 9347 MHz, 9350 MHz, 9354 MHz
Maximum Range	320 nautical miles in weather
Noise Figure	5 dB maximum
Dynamic Range	60 dB minimum
Gain Control	Automatic and manual
Attitude Inputs	Three-wire analogue input per ARINC 407 Two-wire analogue input per ARINC 407
Control Inputs	Four ARINC 429 data buses per ARINC 708A
Data Outputs	Three ARINC 453 data buses per ARINC 708A One ARINC 429 Hazard bus per ARINC 708A

(1) The RTA-4B unit is housed in a single 8 MCU package, as specified by ARINC Characteristic 708A. There are two units installed in the radar bay (1S23 and 2S23) and each unit is secured to the MBA-4B RX/TX mount (tray) in the aircraft shelf 29-123 (Ref. Fig.1, sheets 1 and 2). At the rear of the unit, a low-insertion-force connector containing a waveguide insert and 13-pin and 150-pin inserts is connected to a mating connector, mounted on the tray.

(2) Cooling for the RTA-4B unit is in conformance with ARINC 600 and is accomplished by the aircraft blower system and with a tray-mounted fan forcing air through the unit. Two handles on the front panel facilitate removal and replacement of the RTA-4B unit.

(3) An ATE housing assembly on the RTA-4B front panel contains a liquid-crystal display (LCD) fault annunciator, two pushbutton software test switches and a 25-pin auxiliary ATE connector. The auxiliary connector enables automatic test equipment (ATE) to be used. The ATE connector pins are connected to internal circuit functions which are not available at the rear connector but are necessary for ATE purposes.

E. RTA-4B Receiver/Transmitter - Unit Functionality

(1) The basic RTA-4B RX/TX unit is a lightweight airborne unit consisting of a transmitter, receiver, video processing circuitry, windshear processing circuitry, digital and analogue interfaces, stabilization servo-loop circuitry, system monitoring circuitry and power supply. The microwave connection to the unit is an integral part of the unit main connector conforming to ARINC 600.

(2) The transmitter section is solid-state throughout. The RTA-4B operates at a nominal frequency of 9345 MHz. A frequency agility feature is incorporated to shift frequency up or down to reduce mutual interference with nearby transmitters. In weather mode, it transmits alternating 6- and 18-microsecond coherent pulses. Additional 6-microsecond pulses at a 1600-Hz rate are used in turbulence mode.

(3) For the weather (WX) and terrain-mapping (MAP) modes, the basic transmit-receive period is 5.25 milliseconds. This results in a basic pulse repetition frequency (PRF) of 190 Hz. However since two pulses (6 and 18 microseconds wide) are transmitted, the PRF is specified as 380 Hz.

(4) The received echoes from the 6-microsecond pulses are processed to produce targets ranging from zero to 20 nautical miles on the radar indicator. Received echoes from the 18-microsecond pulses are processed to produce the targets located at distances greater than 40 nautical miles. Received echoes from both the 6-microsecond pulses and the 18-microsecond pulses are processed to produce the targets located at distances between 20 and 40 nautical miles.

(5) When the turbulence mode is selected, the system shifts to an interlaced high and low PRF pattern to acquire intensity as well as turbulence information simultaneously. The high PRF rate necessary for Doppler processing limits the turbulence detection range to 40 nautical miles. When a range greater than 40 nautical miles is selected in turbulence mode, the indicator will display weather plus turbulence to a range of 40 nautical miles, and weather only beyond 40 nautical miles. In turbulence mode, interference is minimized by varying the timing between each PRF cycle.

(6) An automatically initiated self-test is performed by the RTA-4B when the equipment is turned on. The system provides continuous monitoring capability when not running in initiated test. This built-in test equipment (BITE) feature of the RTA-4B includes a maintenance processor that provides LRU-level fault isolation information through fault displays on the radar indicator. The fault data is stored in a non-volatile fault memory in the RTA-4B for use by shop-level maintenance personnel.

(7) A pair of pushbutton software switches on the front panel of the RTA-4B can be used to call up various menus on a front-panel liquid-crystal display (LCD) to enable automatic testing of the radar system LRUs and other parameters. BITE results are displayed on the LCD.

(8) A manual self-test of the radar system is also selectable from the control unit. This test verifies system calibration and performance capability and isolates substandard performance to the most probable line-replaceable unit (LRU). Results of the test are displayed as a standard test pattern on the radar indicator.

F. Inputs and Outputs - ARINC 453 Display Data Bus

(1) The RTA-4B provides serially formatted 1600-bit ARINC 453 data words which are outputs to the displays over ARINC 453 data buses displays. Each display data word is Manchester bi-phase modulated and is preceded and followed by beginning and end-of-word sync fields. The first 64 bits of the data word contain an 8-bit label, system control fields, a "range echo", various system status fields and a 12-bit scan-angle field. The remaining 1536 bits contain radar-return intensity data formatted as 512 three-bit range bins over the selected range, the coding of each three weighted bits identifies the level of intensity of that return.

(2) The radar-return intensity data is derived from integrated received video and the processed data is clocked out serially from a RTA-4B video interface at the 1-MHz bit rate. The 1.6-millisecond data word is transmitted at intervals of approximately 5.25 milliseconds.

(3) The position of the antenna (in azimuth) as it scans is encoded using bits 52 through 63. Bits 43 through 48 indicate for which weather data is being processed.

(4) The GAIN control on the control unit is encoded in bits 37 through 42. Maximum gain is represented by binary code 000000 and minimum gain is represented by 111110. Binary code 111111 (CAL) indicates that the receiver establishes its own gain level (control unit GAIN control set to AUTO). The antenna tilt angle is established by the TILT control on the control unit. Bits 30 through 36 contain the manual tilt information.

(5) Bits 27, 28 and 29 provide a 3-bit code that indicates one of eight possible selected operating modes.

(6) Bit 26 indicates whether or not the antenna stabilization is turned on at the control unit.

(7) Bits 18 through 25 are used for fault information. The first eight bits of the display data word contain its identifying octal label, 00101101 (octal 055).

G. Inputs and Outputs - ARINC 429 Control Data Buses

(a) The RTA-4B receives ARINC 429 serial 32-bit data control words from the radar control unit and radar indicator that establish the operating conditions for the receiver/transmitter. The ARINC 429 control word from the radar control unit defines the selected operating mode, antenna tilt angle setting, receiver gain setting and other information. The ARINC 429 control word from the radar indicator defines the selected range.

(b) The RTA-4B derives its operating mode, antenna tilt angle, and other control information from ARINC 429 control word 1 generated by the control unit. Control word 1 is a 32-bit serial data word containing an 8-bit label followed by fields describing the positions of the mode selector switch, stabilization switch, TILT control and GAIN control.

(c) The range selected on the display is encoded in ARINC 429 control word 2, produced by the associated display. This 32-bit serial word contains an 8-bit label followed by a 6-bit range field.

(d) The RTA-4B accepts a 32-bit serial control word only if it begins with a correct identifying label. These are octal label 270 for control word 1 and octal label 271 for control word 2.

(e) The RTA-4B determines system configuration automatically by analysing inputs to Control Buses 0, 1 and 2. Control Bus 0 delivers control word 1 from the control unit to the RTA-4B and Control Bus 1 and 2 deliver control word 2 containing range-selection data from the indicator to the RTA-4B (Ref. Fig.2).

H. RTA-4B Receiver-Transmitter - Unit Operation

(1) The principal functional elements that comprise the RTA-4B Receiver-Transmitter are shown in Fig.5.

(2) The master processor (MP) module (Ref. Fig.5) functions as the host control computer for the RDR-4B radar system. It also produces the timing and control signals that control the operations of the modulator/transmitter, receiver, X6 and X9 multipliers and the weather, turbulence and windshear digital signal processor (DSP) circuits. The MP module decodes the ARINC 429 mode information from the control unit (control word 1) and selected range from the radar indicators (control word 2) and downloads this data to the DSP circuits whenever a mode change occurs.

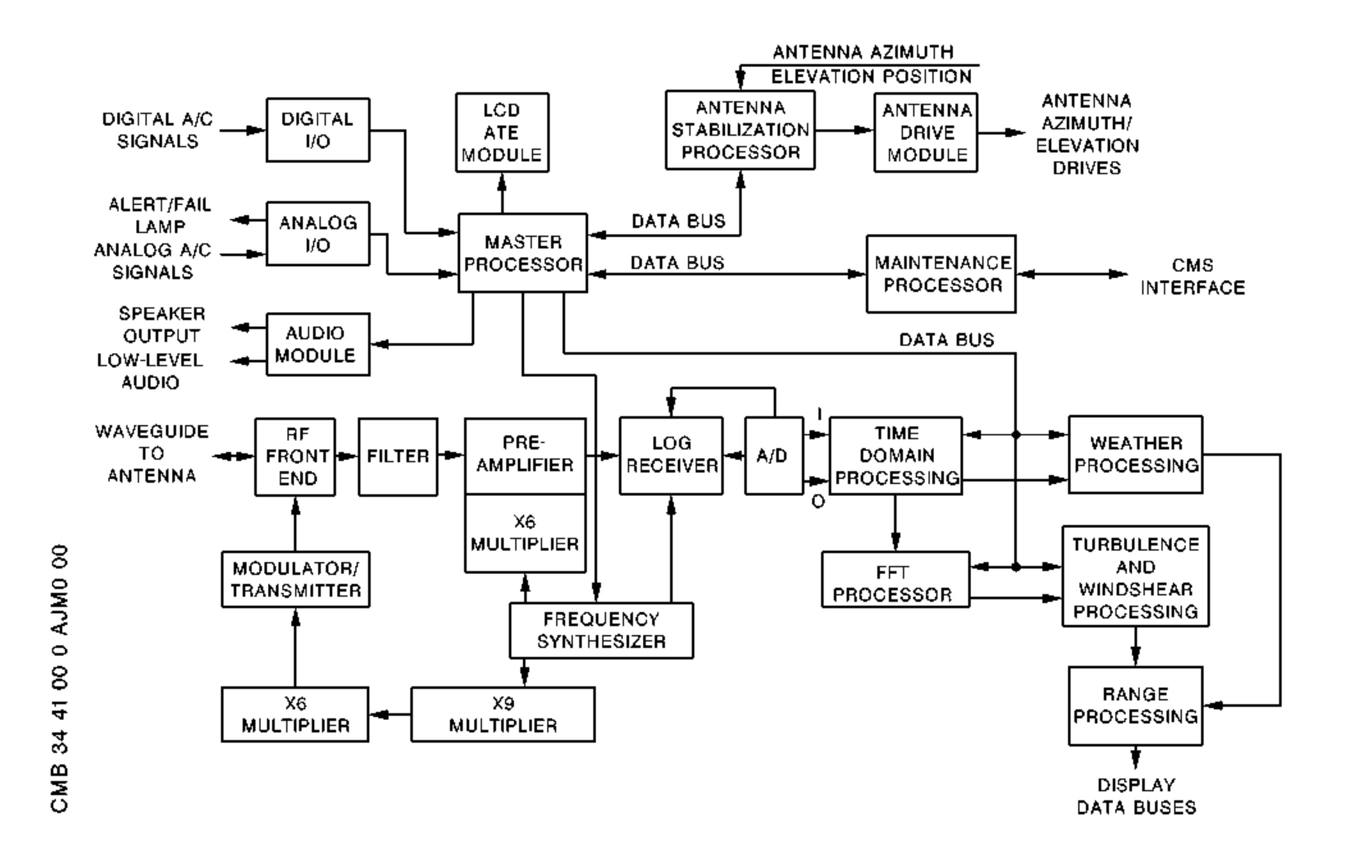
(3) The frequency synthesizer provides a crystal-controlled, synthesized reference frequency for both transmit and receive operations. From this reference frequency, the receiver first and second mixer local oscillator frequencies and intermediate transmitter and receiver frequencies are produced. Frequency agility is used for transmitting to allow the transmitter to shift frequencies to reduce noise.

(4) A X9 frequency multiplier receives an input signal at approximately 173 MHz from the frequency synthesizer. During the transmit period, the X9 multiplier furnishes an output signal at frequency of approximately 1557 MHz. This signal is routed to the high-power X6 frequency multiplier, which produces the final transmitting frequency of 9,345 MHz (nominal). The X6 frequency multiplier output is applied to the modulator/transmitter.

(5) The low-power X6 frequency multiplier, which is part of the pre-amplifier assembly, receives an input signal at approximately 1,593 MHz from the frequency synthesizer and produces a 9,557 MHz (nominal) output which is applied as the local oscillator signal to the first mixer.

(6) Timing signals activate the modulator/transmitter during the transmit period to produce the pulse-modulated X-band radar output. This output signal is routed through the waveguide elements of the RF front end to the radar antenna.

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RTA-4B Receiver-Transmitter Simplified Block Diagram
Figure 5

(7) During the receive period, radar returns pass through the waveguide elements in the RF front end and through a filter to the pre-amplifier. The pre-amplifier provides amplification with low noise and narrow-band pre-selection of the received signals. The received signal is mixed with the 9557 MHz local oscillator signal at the first mixer to produce the 212 MHz first i-f signal, which is sent to the receiver.

(8) The receiver operates with automatic gain control (AGC) fed back from the analogue-to-digital (A/D) converter. The receiver provides high-gain, narrow-band, logarithmic amplification. It converts the 212-MHz first i-f signal to a 5 MHz third i-f signal, by mixing the incoming i-f signal with the second and third local oscillator frequencies. Fast AGC codes produced by the unit's digital signal processor (DSP) sub-system modulate the gain of the receiver from range bin to range bin during the 6-microsecond pulses. The receiver 5 MHz i-f signal output is applied to the A/D converter at the input to the DSP sub-system.

(9) The detected video from the receiver is digitized by the A/D converter and the digital i-f signal is sampled by a digital-to-analogue converter which produces the slow AGC control voltage for the receiver. The digital i-f signal is processed in the DSP sub-system to accommodate up to three separate radar indicators with independent range selection. This circuitry averages the digitized video data within each range bin. A range bin is defined as the range interval over which the radar data is being derived. It is determined by dividing the selected range into 512 equal increments. This video averaging is performed every transmission. The averaged data is stored and filtered by processing returns from successive transmissions. This PRF-to-PRF integration improves system performance. Narrow-band reception is further enhanced by the selection of a 40 kHz i-f bandwidth before each 18-microsecond pulse transmission, a 120 kHz i-f bandwidth before each 6-microsecond pulse transmission and a 400 kHz i-f bandwidth before each windshear pulse transmission.

(10) For Doppler processing, the spectrum width of the received signal is computed. This spectrum width correlates with random motions of rain droplets caused by weather turbulence. The DSP circuitry examines small areas of storm cells with successive pairs of transmitted pulses for Doppler frequency shifts, and then computes the auto-correlation between them.

(11) A PRF delay function for pulse-pair processing provides range and azimuth compensation for turbulence thresholds. The antenna tilt angle is used to set turbulence thresholds.

(12) The system shifts to the interlaced high and low PRF pattern to acquire intensity as well as turbulence information when the turbulence mode is selected. To eliminate any range ambiguity in the Doppler processing caused by the high 1600 PRF, the turbulence return information is compared to the weather intensity information acquired at the low PRF. This comparison enables separation of primary target returns from any range-ambiguous echoes.

(13) The analogue-to-digital conversion module serves as the front end for the DSP subsystem, which also includes the time-domain, weather, Fast-Fourier Transform (FFT), range and turbulence processing circuits. The A/D module converts the band-limited i-f signal from the receiver module to a digital data flow that is fed directly to the time-domain processing circuits.

(14) The A/D module contains a DSP device which communicates with the MP module, develops and controls the slow AGC feedback voltage, and performs calibration operations on the i-f A/D converter.

(15) Time-domain processing is accomplished on the time module (TM), which is the second module in the signal processing chain. It performs functions on the incoming digitized signal from the A/D module in the time and cross-range domains, and produces a time-domain output signal to the frequency module (FM) for further processing.

(16) Two DSP devices are linked together on the TM to perform these required functions. They operate together to process the digitized output signal from the A/D converter module. Processing is synchronized to the main trigger every pulse repetition interval (PRI). The sampled receiver signal is processed and forwarded to the next module (frequency module) in the DSP chain.

(17) The frequency module (FM) provides range-Doppler filtering in the windshear mode of operation. This module is bypassed in other radar operating modes. Range-Doppler filtering consists of analysing time samples of the incoming radar returns for each range bin over several PRIs to determine Doppler shifts.

(18) The next module in the signal processing chain is the signal module (SM). It performs functions on the incoming digitized signal from the TM (weather or turbulence) or FM (windshear) and passes the processed signal to the range module (RM) as data.

(19) The number 1 signal processor in the signal module (SM) adjusts the signal level with sensitivity timing control (STC). This allows nearby echo signals to be displayed with the same intensity as distant ones. STC is effective to about 70 nautical miles. In the MAP mode, STC is modified to optimize analysis of terrain features.

(20) Range processing is accomplished by the range module (RM), which is a two-processor subsystem containing the hazard processor and range converter. The hazard processor performs the functions such as ground tracking, azimuth angle smoothing using Alpha-Beta tracking, azimuth compensation and clutter-error compensation.

(21) The range converter performs functions such as receiving the input encoded levels, performing range-specific scan conversion and providing the ARINC 453 scan output to the video processor.

(22) The MP receives and formats the current antenna azimuth and elevation position from the antenna stabilization processor, selected range from the radar indicators, selected mode from the control unit, and any detected faults, for downloading to the DSP modules. The processed weather-intensity range bin data along with this control data are formatted into 1600-bit ARINC 453 words which are bused to the radar indicators at 5.25-millisecond intervals.

(23) The microprocessor-controlled antenna stabilization processor, processes aircraft analogue pitch and roll attitude inputs from 2-wire or 3-wire gyros from the inertial navigation system, antenna azimuth and elevation angles from the azimuth (scan) and elevation synchro transmitters, and selected antenna tilt angle for line-of-sight stabilization. The antenna stabilization processor generates the azimuth and elevation control phase voltage drive signals to the antenna drive module, which then produces the required outputs to drive the antenna. It also monitors antenna operation and functioning of the antenna drive module circuits.

(24) Also, due to the nose lowering for take-off and landing, there is nose droop compensation for the radar to lift the antenna for line of sight scanning. The RTA-4B provides 26V ac/400 Hz reference signal to the nose droop position synchro transmitter which feeds back the nose position to the RTA-4B antenna stabilization processor.

(25) The elevation drive motor is a two-phase servo-motor which operates with a reference phase voltage of 115V, 400 Hz supplied by the RX/TX to one winding and a 400-Hz control phase voltage of varying amplitude applied to the other winding. The reference phase voltage is applied at all times while the control phase is applied only when needed to reposition the antenna planar array in elevation as ordered by the stabilization microprocessor circuitry in the RX/TX unit. The control voltage is an error voltage supplied by the stabilization microprocessor circuitry.

(26) The elevation motor repositions the antenna in elevation until the phase of the error voltage induced in the control winding reaches a null. The speed at which this correction is performed is dependent on the error voltage amplitude.

(27) The RX/TX unit also supplies the azimuth motor drive signal which drives the antenna through the oscillating 180 degrees of azimuth (scan). Controlled by the microprocessor circuitry in the RX/TX unit, the 115V drive signal is applied to one of the dual windings in the azimuth motor. The motor rotation drives the gear train, which in turn drives the antenna to one side of the straight ahead zero-degree heading. The azimuth synchro in the drive unit continuously transmits the antenna angle position to the stabilization microprocessor circuitry. When the antenna reaches the 85-degree position, the microprocessor through triac switching removes the 115V drive signal from the azimuth motor. The antenna continues to coast in the direction of its movement until the microprocessor circuitry determines the antenna has reached 90 degrees, at which time the 115V drive signal is applied to the other of the dual windings in the azimuth motor to drive the azimuth motor in the reverse direction. The antenna therefore is driven in the reverse direction, from the 90-degree angle position through the straight-ahead, zero-degree position and toward the 90-degree angle position of the opposite side. The microprocessor circuitry again removes the 115V from the azimuth motor when the antenna position has reached 85 degrees and the antenna coasts to the 90-degree angle position. The microprocessor circuitry applies the 115V drive signal to the motor winding which initiates reverse rotation each time the antenna position angle is 90 degrees, causing the antenna to constantly scan the 180-degree sector straight ahead.

(28) The antenna stabilization (AS) microprocessor periodically monitors the operation of the antenna drive unit. It checks the antenna elevation movement to verify that the antenna is not being driven too fast and that the antenna is being operated within the antenna stabilization limits. The AS microprocessor also checks the antenna azimuth rate every 1.2 seconds to maintain desired minimum azimuth scan rate and to verify antenna turnaround.

(29) The MP monitors the operation of the RTA-4B circuits as well as the operation of the radar system LRUs (indicators, control unit and antenna drive unit). It receives an indication of the operational status of the antenna drive unit from the antenna stabilization processor. Discrete signal inputs also provide status of the waveguide switch, aircraft gyros and RTA-4B cooling.

(30) Detected faults are coded and stored in a non-volatile fault memory in the memory section of the master processor (MP) module. When a fault is detected and stored, it is made available to the front-panel LCD display when the "test" pushbutton is pressed.

(31) The RTA-4B power supply (not shown in Fig.5) produces regulated output voltages from the aircraft 115V 400 Hz input and is protected by the 5A aircraft circuit breaker. The RTA-4B is placed in the standby mode whenever ac power is applied to the unit even when the mode selector switch on the control unit is set to OFF.

(32) The RTA-4B furnishes the control unit with its required operating voltages (+12V and +28V dc). The RTA-4B also furnishes power to the antenna drive unit, fan and waveguide switch.

(33) When the RTA-4B is powered on, the 5V dc supply turns on a triac switch that connects 115V ac to the fan output. This output furnishes power to a tray-mounted blower. When the antenna ac-on signal from the I/O control goes low, it enables another triac switch that connects the ac return for the 115V 400 Hz power applied to the power transformer through the triac switch and current sensor. The power transformer then supplies the antenna with a 26V 400 Hz reference, which is used as the synchro excitation voltage by the antenna. This voltage, after it is scaled down and filtered, is also used as a reference by the antenna stabilization processor circuits.

(34) A temperature transducer produces the TEMP - SENSE output signal to the A/D converter module. This signal provides an indication of ambient temperature in the power supply. Excessive temperature triggers an RX/TX cooling fault.

I. Waveguide Assembly

(1) The waveguide assembly provides a transmission line for carrying X-band energy between the RX/TX and the antenna. This assembly is used in both transmission and reception.

(2) The mechanical dimensions of this assembly are designed for maximum transmission with a minimum loss along the line.

(3) The waveguides are designed for the X-band.

(4) The waveguide assembly can be broken down into two parts:

(a) A waveguide transmission line.

(b) A waveguide changeover switch.

J. Waveguide transmission line (Ref. Fig.6)

(1) The waveguide transmission line is made up of metal and flexible sections, it is routed in Zones 114, 122 and 124. It is accessible by means of doors in the above zones, sections (a) and (c) are preformed flexible waveguides. Sections (b) and (e) are flexible waveguides and connectors. Section (e) has a connector fitted with a pressurization adapter. Section (d) is a spiral metal waveguide. Sections (f) and (g) are pre-formed metal waveguides. These sections are interconnected by one of the following methods:

- Connection made with 4 wirelocked screws for sections which are not often removed.
- A quick disconnect system for rapid removal of sections which must be removed frequently (antenna connection).

(2) Radio electrical insulation is provided by quarter wave choke joints between each waveguide section and with RF gaskets on the transceiver mount waveguide sections.

K. Waveguide Pressurization (Ref. Fig.6)

(1) The AVQ-30X radar waveguide pressurization system was required to prevent arcing in the waveguide due to the high power of the radar and the high altitudes flown. Waveguide pressurization is not considered necessary with the RDR-4B due to the low power of the radar. However, radar pressurization system remains in place and pressure is maintained by the pressurization system which consists of a bleed of cabin air pressure through a desiccant bottle in the radar bay at frame 10 via rigid tubing to the waveguide pressure connector in waveguide section (e). Sections (d), (e), (f) and (g) are in a pressurized zone of the aircraft, while sections (a), (b) and (c) are in a non-pressurized zone of the aircraft. Connection between guides (d) and (c) is made by means of a bulkhead seal, as Zone 114 is not pressurized. Rubber O rings seals are inserted in the flange joints between waveguide sections to prevent pressure leakage. The pressure is maintained, at one end of the waveguide by a thin Mylar sealing window within all antenna drive units, and at the other end by a Mylar window insert adjacent to the waveguide switch. Sealant is used between the Mylar window insert and the flex waveguide flange.

(2) Although arcing is not an issue even if the drive unit plastic window was to fail, but continuous bleed of cabin pressure through the waveguide would result in additional workload for the environmental control system and this would be a hidden failure. Pressure tests are therefore to be conducted when a new antenna drive unit is fitted.

L. Waveguide Switch

(1) The waveguide switch (S29) is installed on the RX/TX mount.

(2) The purpose of the switch is to connect the selected RX/TX to the waveguide transmission line while the other system is in standby.

(3) Selection is made by means of SYSTEM switch on the control panel.

M. Waveguide Switch control

(1) Positioning the control panel SYS switch to OFF disables the two position rotary waveguide switch and causes it to be stationed in its normally closed position, interlocked with No.1 RX/TX. Positioning the control panel SYS switch to RX/TX No.1 or RX/TX No.2 with either indicator not in Standby, enables the respective RX/TX supply. +28V dc is then derived from the selected RX/TX, through the control panel to the rotary waveguide switch control input pins. The +28V dc from the waveguide switch is routed back to the selected RX/TX waveguide switch position interlock sense circuits. RF power output from the selected RX/TX is then applied through the open waveguide port.

(2) As described above, when the waveguide switch is located in its selected position, the analogue I/0 module in the selected RX/TX receives a +28V dc interlock input from the waveguide switch. If the interlock signal is not present, the RX/TX Master Processor checks the unregulated +28V dc and control unit to determine the source of the fault. If both the unregulated +28V dc and control word 1 are good, the RX/TX Master Processor determines the fault condition as a waveguide switch fault. This fault may be displayed as a control unit fault (CON FAULT) on the indicator.

N. Radome

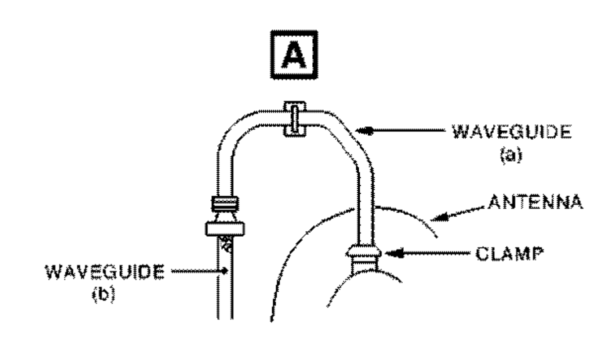
(1) The radome forms the nose tip of the aircraft fuselage, and is approximately conical in shape. The nose probe is mounted on the tip of the cone.

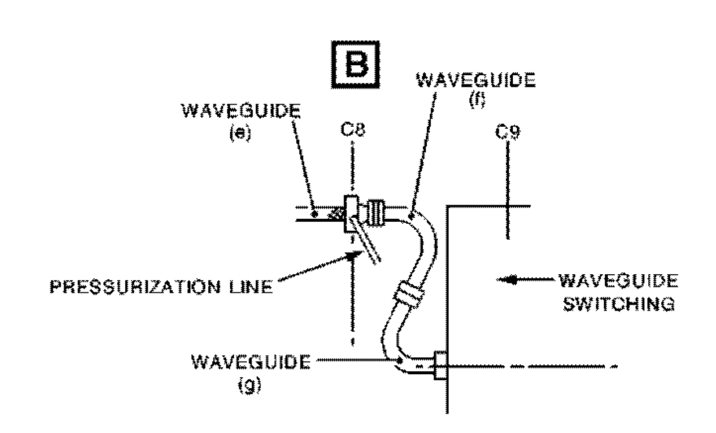
(2) The radome protects the radar antenna and presents minimum obstruction to radio signals and so causes only limited attenuation in system performance.

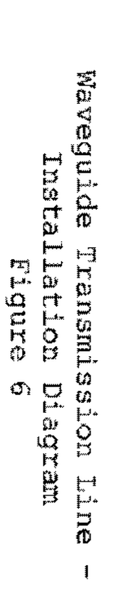
(3) It is mounted on the aircraft structure by means of sliding rails which permit checking and removal/installation of the antenna and is normally secured by screws.

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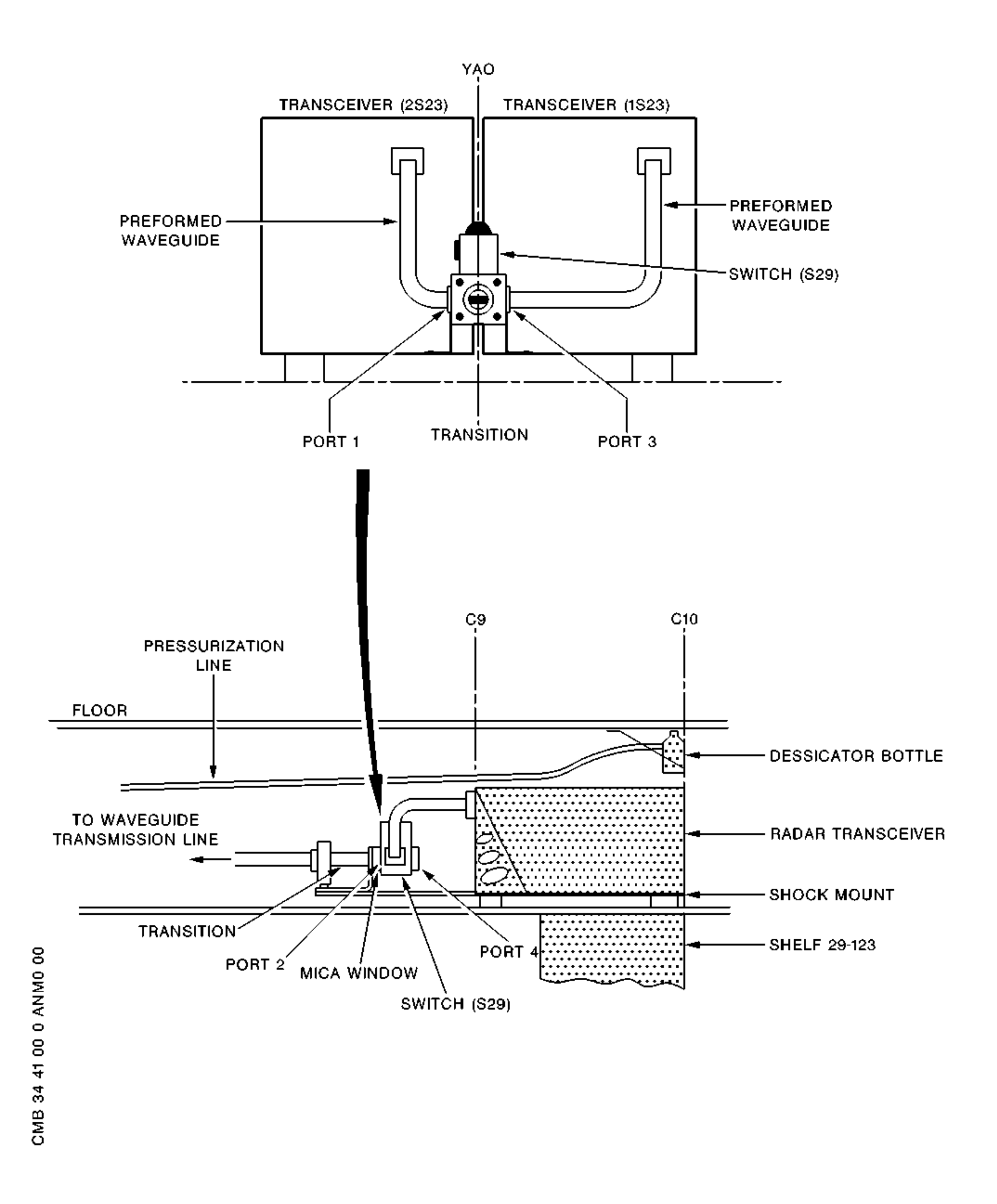
A
(a)
DROOP NOSE
ANTENNA
FEED THROUGH SUPPORT
(b)
C2 C2A C3 C4 C5 C6 C7 C8 C9 C10
FLOOR
PRESSURE SEAL
WAVEGUIDE (d)
WAVEGUIDE (c)
PRESSURIZATION LINE
WAVEGUIDE (e)
B
RADAR TRANSCEIVER
SHELF 29/123
DESSICATOR BOTTLE
WAVEGUIDE (f) (g)
WAVEGUIDE SWITCHING
ZONE 111/114 ZONE 122/121 ZONE 24/123
NON PRESSURIZED ZONE PRESSURIZED ZONE



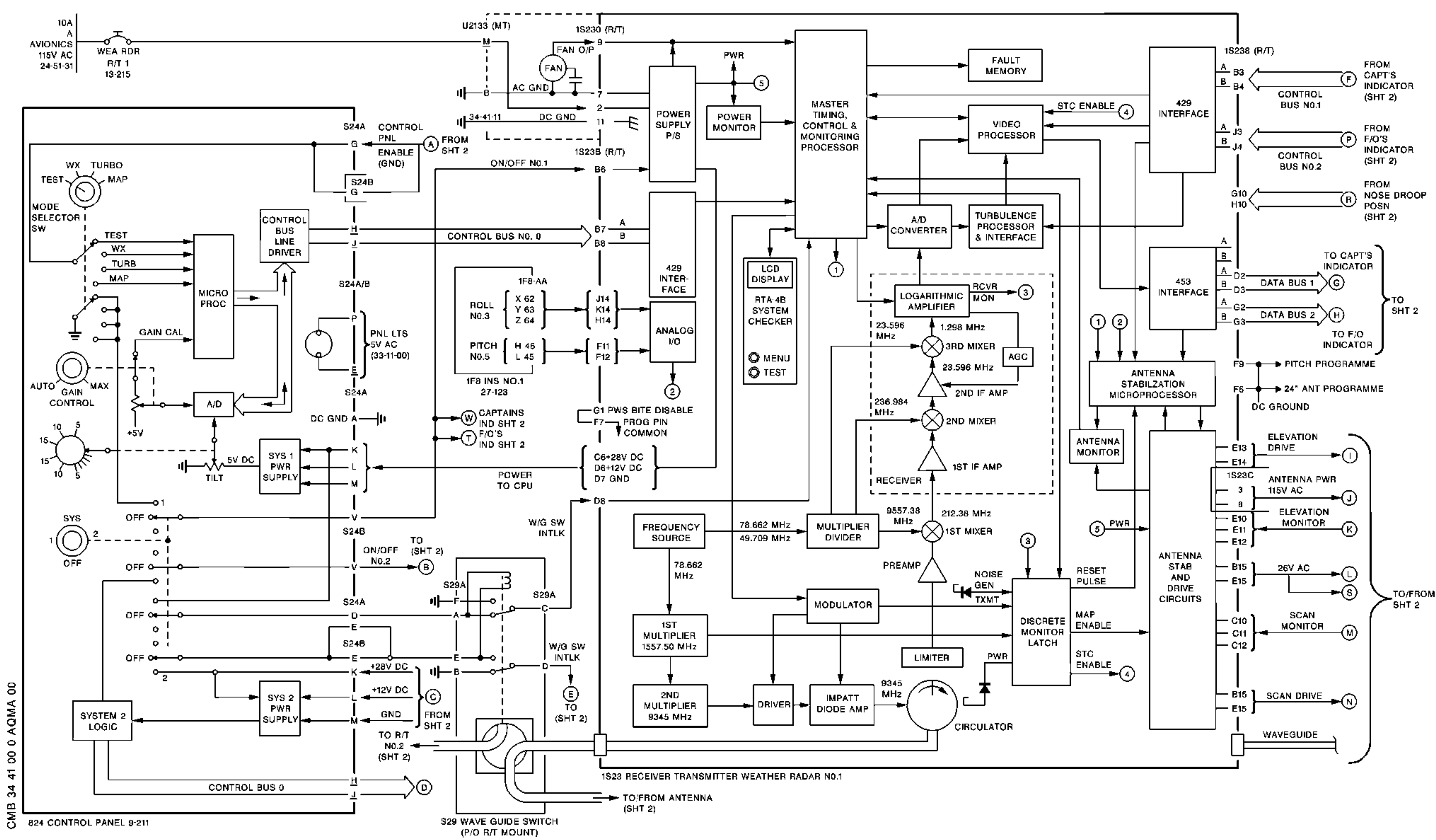




Waveguide Transmission Line - Installation Diagram
Figure 6

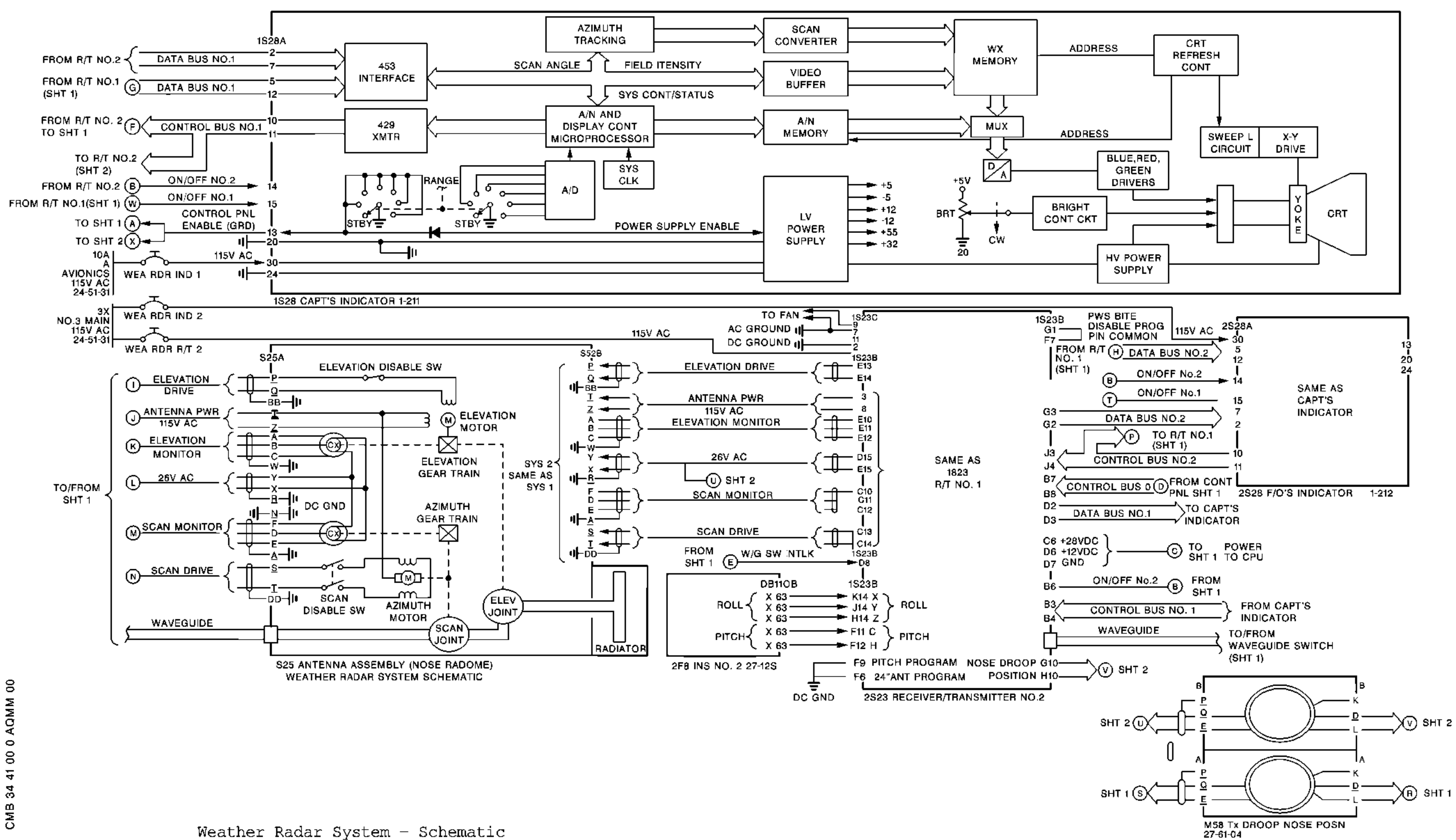


Waveguide Switching - Installation Diagram
Figure 7



CMB 34 41 00 0 AQMA 00

Weather Radar System - Schematic
Figure 8 (sheet 1 of 2)



Weather Radar System - Schematic
Figure 8 (sheet 2 of 2)

3. System Description

This section consists of a brief Functional Description of Weather Radar Operation, Control of the Radar System, Normal Operation, System Monitoring and Messages and System Shutdown Procedures.
Normal operation describes normal start-up operation and the various modes of the weather radar system.
The system shutdown procedures are performed when weather radar operations are completed.

WARNING: DO NOT OPERATE WEATHER RADAR WHILE THE AIRCRAFT IS BEING REFUELLED OR DEFUELLED.

DO NOT OPERATE IN ANY RADIATION MODE WHILE A FUELLING OPERATION IS BEING CONDUCTED WITHIN 300 FEET OF THE ANTENNA OR AN EXPLOSION MAY OCCUR.

PERSONNEL MUST NOT ENTER AN AREA CLOSER THAN 50 FEET (45.75 m) OF A RADIATING ANTENNA OR INJURY TO PERSONNEL MAY OCCUR.

A. Functional Description of Weather Radar Operation (Ref. Fig.8)

(1) Power for the weather radar system is obtained from circuit breakers (1S30 and 1S32, 2S30 and 2S32), located on CB panels 13-215 and 13-216 which are connected to the aircraft 115V ac, 400 Hz electrical network.

(2) The Receiver-Transmitter operates by emitting very short, intense pulses of microwave energy which are reflected within the range of the radar system. A portion of the radiated energy, reflected by an object having reflective characteristics, is returned along the same path to the aircraft where it is received by a scanning antenna and fed to the RX/TX via the waveguide. The received signal is amplified and digitized by the RX/TX and then serially formatted into 1600-bit ARINC 453 words that are transmitted to independent radar indicators over separate data buses to display the weather information ahead of the aircraft.

(3) The maximum range of the RDR-4B Weather Radar System depends upon many factors. The most important are antenna gain, beam width of radiated energy, transmitter power, pulse width, PRF, noise figure, receiver gain, radome and interconnecting waveguide losses.

(4) The RX/TX processes the pitch and roll inputs from the INS (INU No.1, 1F8 or INU No.2, 2F8), and nose droop position for stabilization, azimuth and elevation feedback from the antenna, and selected antenna tilt angle to derive the antenna azimuth and elevation drive signals. The RX/TX furnishes power to the antenna drive unit, control panel, cooling fan and the waveguide switch control circuits.

(5) During each 5.25-millisecond period of RX/TX operation, built-in tests are conducted automatically to provide qualitative checks of the principal functional circuits of the RX/TX, as well as the associated LRUs.

(6) The RDR-4B faults are displayed on the radar indicator as LRU faults and will be displayed on the RTA-4B front-panel LCD display when self-test is selected manually. Except for a cooling fault, a fault detected in the RTA-4B will be annunciated as an R/T FAULT.

B. Weather Radar System Control Functions

(1) The radar system is placed in the standby mode whenever the aircraft 115V 400 Hz power is applied to either of the receiver/transmitters and if the control unit system (SYS 1/OFF/2) transfer switch is in the OFF position or both indicators range control switch is in STBY.

(2) The following conditions apply to the RTA-4B in the standby mode:

- The RTA-4B transmitter is inhibited and no power is applied to the antenna.
- The ARINC 453 data output from the RTA-4B to the indicators is inhibited.
- The RTA-4B master processor (MP) module circuits are operational.

(3) For the radar to operate and display the test pattern or weather data, at least one display must be out of STBY and one RX/TX must be selected at the system (SYS 1/OFF/2) transfer switch on the control panel.

(4) When selection of an RX/TX is performed, a power enable ground signal from the control panel turns on the selected RX/TX internal power supply which generates voltages for the RX/TX, the control panel and the selected RX/TX mount cooling fan. The antenna receives 115V power supplied through the antenna stabilization and drive circuits in the RX/TX.

(5) As seen in Fig.2 and Fig.8, RX/TX No.1 receives 32-bit serial range data encoded in control word 2 on ARINC 429 control bus No.1 from the captain's indicator and sends information on ARINC 453 data bus 1 and 2 to the captain's and first officer's indicators respectively. RX/TX No.2 receives data on ARINC 429 control bus No.2 from the first officer's indicator and sends information on ARINC 453 data bus 1 and 2 to the captain's and first officer's indicators respectively.

(6) The detailed control logic for the radar system is described below and can be seen in Fig.8.

(7) When aircraft power is available, the indicator 115V ac power is applied to the indicator low voltage power supply which is enabled when the indicator range switches are in any position except STBY. The indicators and RX/TXs are placed in STBY by selection of the range switch on both indicators to the STBY position, irrespective of the control panel switch selection. If one indicator has its range control in STBY and the other indicator is out of STBY, then both indicators are able to display data. If the indicators are then turned on by the action of the control panel SYS switch, the indicator in STBY will display a 5 nautical mile range if Weather or MAP modes are selected.

(8) The low voltage power supply enable (ground) signal in the indicator is also used as the control panel enable signal. This control panel enable signal from the indicator (pin 13 on each indicator) sends a ground to the control panel (pin G on S24A), through the mode selector switch to the control panel microprocessor.

(9) When the control panel SYS 1/OFF/2 switch is placed in either the SYS 1 or SYS 2 position, the ON/OFF 1 or ON/OFF 2 ground (out of pin V on the associated control panel rear connector, S24A or S24B) is established at the selected RX/TX unit (pin B6) and each of the indicator's ON/OFF control logic (indicator pin 15 if selected to SYS 1, or pin 14 if selected to SYS 2). The ON/OFF signal is fed to the ARINC 453 data word interface to provide selection of digital video data from the operating RX/TX unit to be displayed as weather data on the indicator.

(10) The application of the ON/OFF ground on pin B6 of the RX/TX unit causes the RX/TX power supply to be activated but the remainder of the RX/TX does not fully operate until its microprocessor circuits receive valid data from the ARINC 429 control word 1 (containing operating mode) on control data bus 0 from the control panel. Specifically, the system ON/OFF ground going into pin B6 of the selected RX/TX, acts to turn the RX/TX power supply on and causes the following to occur:

- The RX/TX supplies A, B, & C power outputs to the control panel.
- The RX/TX (Power A) output is a 28V dc voltage output on pin C6 which is applied to pin K of the associated control panel connector (S24A for RX/TX No.1 or S24B for RX/TX No.2).

(11) When the control unit receives power, it then outputs the 28V dc received on pin K (routed via the SYS 1 & 2 switch) to S24A pin D if RX/TX No.1 is selected, or out of S24B pin E if RX/TX No.2 is selected.

(12) The 28V dc out of the control panel is then applied to the Waveguide switch connector S29A, pin A if RX/TX No.1 is selected or pin E if RX/TX No.2 is selected. This switching voltage fed to the waveguide switch transfers the antenna waveguide to the selected RX/TX unit. The transfer is interlocked in such a way that correct waveguide connection must occur before the selected transmitter is energized.

(13) The interlock works by having the waveguide switch output/switch the 28V dc out of pin C of S29A if RX/TX No.1 is selected or pin D if RX/TX No.2 is selected. The 28V dc is then supplied to the selected RX/TX middle plug pin D8 (waveguide switch interlock input). If the waveguide switch is in the wrong position, then the 28V dc will not be returned to the selected RX/TX and so a fault will be annunciated.

(14) If either indicator range selector is selected to any position but STBY, as already mentioned previously, this causes a ground (Low Voltage Power Supply ON/OFF) to be internally applied to the indicator low voltage power supply to activate the indicator display and enable the control panel. The enabling of the control panel allows the application of ARINC 429 control word 1 containing the mode selection information which is forwarded to the RX/TX unit on control bus 0 and refreshed periodically. Satisfactory data on control bus 0 and the application of 28V dc on the selected RX/TX middle plug pin D8 allows power to be provided to the antenna to enable scanning to take place.

C. Operational Modes

The RTA-4B provides the following basic modes of operation, test, weather avoidance, turbulence detection and terrain mapping. The mode of operation is selected at the radar control unit.

The following paragraphs provide descriptions of the various RTA-4B operational modes.

WARNING: DO NOT OPERATE WEATHER RADAR WHILE THE AIRCRAFT IS BEING REFUELLED OR DEFUELLED.

DO NOT OPERATE IN ANY RADIATION MODE WHILE A FUELLING OPERATION IS BEING CONDUCTED WITHIN 300 FEET (91.5 m) OF THE ANTENNA OR AN EXPLOSION MAY OCCUR.

PERSONNEL MUST NOT ENTER AN AREA CLOSER THAN 15 FEET (4.57 m) OF A RADIATING ANTENNA OR INJURY TO PERSONNEL MAY OCCUR.

DO NOT OPERATE IN ANY RADIATION MODE WHILE IN THE HANGAR

D. Normal Operation

Preparation for operation of the radar system and shut down procedures is detailed in 34-41-00, Trouble Shooting.

E. Test Mode

(1) The RDR-4B contains a test mode capability which is a non radiating mode. Self-test is initiated when at least one indicator is out of the STBY position. The TEST mode is selected on the control panel mode selector switch and either No.1 or No.2 RX/TX is selected on the SYS switch.

(2) When the test mode is selected, the radar antenna starts scanning and the RX/TX unit goes through extensive self-test of the weather detection system. The normal radar test pattern is displayed on the radar displays (Ref. Fig. 4).

NOTE: The TEST mode for the RX/TX can be entered via the control panel mode select switch, or by pressing the LCD TEST pushbutton on the front of the RX/TX.

(3) In the test mode, the RX/TX generates ARINC 453 test pattern data over the ARINC 453 data buses No.1 and 2 in the form of 1600-bit serial display data words to the radar indicators. The RX/TX Master Processor circuits receive and decode control word 1 from the control panel, which commands the TEST mode, and direct the range processing circuits to output the test pattern display data to the video processor.

(4) The RX/TX transmits several pulses and, after detecting proper operation, shuts down RX/TX operation. During the TEST mode, the antenna is operated. The antenna stabilization processor monitors the changing scan angles from the rotating antenna and processes this data for use by the RX/TX Master Processor, which continuously provides the current scan angle, along with any fault information, to the ARINC 453 output circuits.

(5) When the TEST mode is selected and neither No.1 nor No.2 INU are on, the radar antenna still scans but instead of the normal radar test pattern an ATTITUDE fault is displayed on the radar indicators. The BITE circuits in the RX/TX generate fault messages which are sent through the ARINC 453 data bus to the indicator. These fault messages are listed in the Indicator Functional Description.

(6) A complete test is conducted each time the radar system is turned on, or whenever test mode is selected, at the control unit. The test function may be performed any time that aircraft ac power is applied.

(7) The front-panel LCD readout can be used as a maintenance aid and is activated when the TEST pushbutton is pressed. Faults stored in the unit's fault memory can then be accessed by pressing the appropriate sequence of selections via the software-controlled LCD pushbuttons.

F. Weather Avoidance Mode

(1) WX Mode is initiated when at least one indicator is out of the STBY position, the WX mode is selected on the control panel mode selector switch and either No.1 or No.2 RX/TX is selected on the SYS switch.

(2) When the WX mode is selected, the radar antenna starts scanning. The normal radar WX pattern is displayed on the radar displays (Ref. Fig.9).

(3) The RDR-4B radar system provides storm detection up to a distance of approximately 320 nautical miles.

(4) Cloud formations having less moisture content than is required to reflect a minimum discernible echo signal will not appear on the indicator display.

(5) In the weather avoidance mode, the RX/TX transmits coherent pulses through the antenna, which is suitably tilted for detecting weather targets ahead of the aircraft. The antenna vertically polarizes and radiates the radar pulses in a pencil beam. The RX/TX receives and processes the weather target returns for display on the radar indicators. In the weather mode, both sensitivity time control (STC) and penetration compensation are enabled.

(6) The control unit GAIN control is operative in the weather mode. The GAIN control can be adjusted to better analyse the weather target information. This adjustment provides a reduction in gain of up to 16 dB so that areas of the display vary in colour as the GAIN control is rotated.

(7) The MP decodes ARINC 429 control word 1 to determine the selected mode and selected antenna tilt angle in order to set up the RTA-4B circuits for the appropriate processing operations. The MP provides antenna tilt information on the data bus to the antenna stabilization processor, which uses this information to adjust the antenna to the selected elevation angle, through the antenna drive circuits.

(8) A microprocessor processes the weather returns to indicate areas of precipitation with moderate to high turbulence. This capability enhances the rainfall intensity information provided by the basic radar to enable pilots to avoid threatening weather. The turbulence detection circuitry utilizes the Doppler phenomenon, which causes an apparent echo-signal frequency shift due to relative motion between radar and the target. The Doppler processor measures return velocity variance as an indication of turbulence present in the weather.

G. Terrain Mapping - MAP Mode

(1) MAP Mode is initiated when at least one indicator is out of the STBY position, the MAP mode is selected on the control panel mode selector switch and either No.1 or No.2 RX/TX is selected on the SYS switch.

(2) When the MAP mode is selected, the radar antenna starts scanning. The normal radar MAP pattern is displayed on the radar displays (Ref. Fig.9).

(3) Ground mapping with the radar system provides a plan picture of prominent landmarks and terrain features such as cities, shore lines, mountains, islands, bays, bridges, etc. These terrain features are presented on the indicator in slant range and azimuth bearing with respect to the heading of the aircraft. It is basically identical to the weather avoidance mode, with the following exceptions. The STC compensation is modified to optimize the analysis of terrain features and penetration compensation is deactivated.

(4) The MP decodes control word 1 to determine that map mode has been selected, as well as selected antenna tilt angle and selected receiver gain. When map mode is selected, the RX/TX nullifies penetration compensation and modifies the STC compensation. If the control unit GAIN control is moved out of the AUTO position, the RX/TX adjusts the receiver signal thresholds in response to the GAIN control setting.

(5) Ground Mapping is of prime importance as the extended range of vision for the pilot and his ability to see this terrain map during darkness and overcast conditions when visibility is restricted. The display in ground mapping resembles a pilotage chart and is easily interpreted. Cities, open ground and bodies of water are distinguished by the intensity of the signals they reflect back to the antenna. Cities usually provide the most intense reflections. Open ground and water provide progressively less intense reflections. It should be noted that calm water reflects very little signal back to the antenna. However, very rough water provides a signal return of considerable strength.

(6) The planar antenna array provides only pencil beam. Terrain mapping for short ranges (less than 75 nautical miles) requires tilt adjustments to cover the scan area. Maximum range is approximated by taking the square root of the altitude of the aircraft.

H. Turbulence Detection

(1) TURB mode is initiated when at least one indicator is out of the STBY position, the TURB mode is selected on the control panel mode selector switch and either No.1 or No.2 RX/TX is selected on the SYS switch.

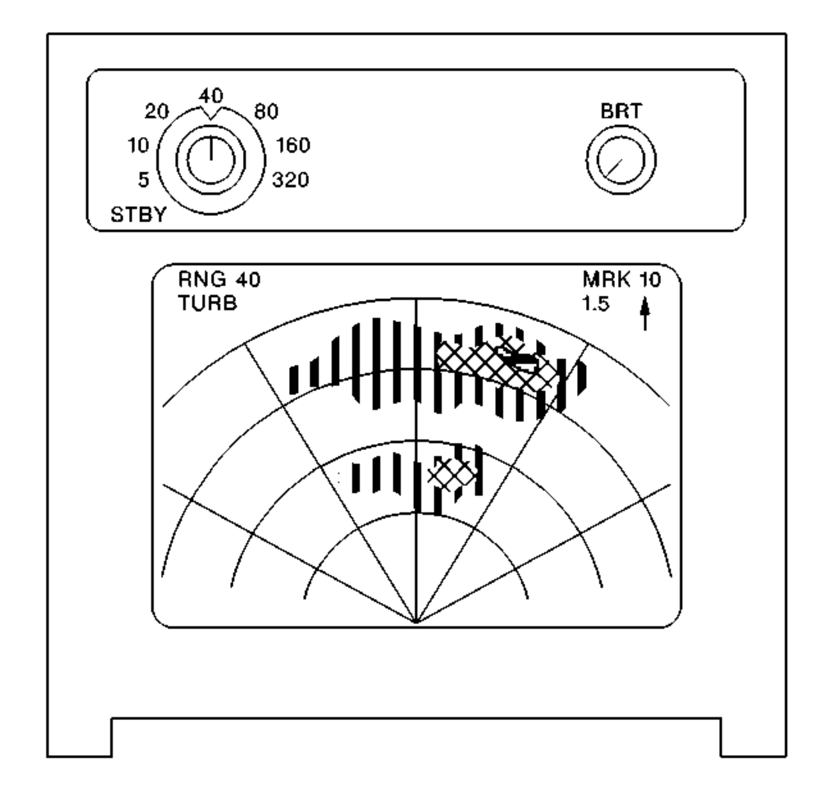
(2) When the TURB mode is selected, the radar antenna starts scanning. The normal radar TURB pattern is displayed on the radar displays (Ref. Fig.9).

(3) In this mode, turbulence information is presented as an overlay to the weather display. The characteristics of the weather avoidance mode are therefore also used in the turbulence mode. The Doppler (turbulence) processor is activated to enable the system to process weather returns that indicate areas of precipitation with moderate to high turbulence. This capability enhances the rainfall intensity information provided by the basic radar to enable pilots to avoid rough air. Areas with moderate to heavy turbulence within a 40 nautical mile range are displayed in magenta.

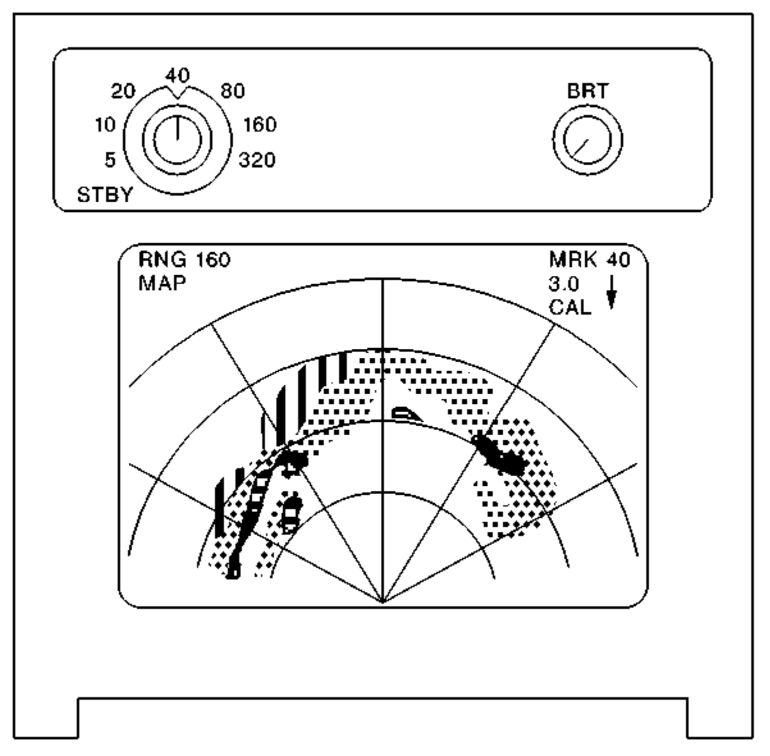
(4) The turbulence detection circuitry utilizes the Doppler phenomenon, which causes an apparent echo-signal frequency shift due to relative motion between the radar and the target. The Doppler processor measures return velocity variance as an indication of turbulence present in the weather.

CMB 34 41 00 0 ASMA 00

Weather
Figure 9 (sheet 1 of 2)



MAGENTA
RED
YELLOW
GREEN



MAGENTA
RED
YELLOW
GREEN

CMB 34 41 00 0 ASMM 00

Turbulence and Map
Figure 9 (sheet 2 of 2)

WEATHER RADAR RDR-4B - TROUBLE SHOOTING

WARNING: OBSERVE THE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

DO NOT OPERATE WEATHER RADAR WHILE THE AIRCRAFT IS BEING REFUELLED OR DEFUELLED.

DO NOT OPERATE IN ANY RADIATION MODE WHILE A FUEL TANKER IS POSITIONED OR FUELLING OPERATION IS BEING CONDUCTED WITHIN 300 FEET (91.5 m) OF A RADIATING ANTENNA OR INJURY TO PERSONNEL MAY OCCUR.

PERSONNEL MUST NOT ENTER AN AREA CLOSER THAN 15 FEET (4.57 m) OF A RADIATING ANTENNA OR INJURY TO PERSONNEL MAY OCCUR.

1. General

A. Built-in test circuitry (BIT) provides a simple and rapid means of checking the RDR-4B system performance. This feature permits a qualitative check of transmitter (TX), receiver (RX), and indicator performance in the air or on the ground. A liquid crystal display (LCD) located on the front of the RX/TX unit, in conjunction with the test pattern and fault legends on the indicator, assist the technician in isolating the trouble to a line replaceable unit (LRU). The RDR-4B has the capability through the BIT circuitry and LCD to determine if the external LRU's are providing the correct inputs.

B. The legend field locations (Fig.101) and the messages displayed are described as follows:

(1) Legend field A - Located at the top left corner, displays, in blue, the selected range. A flashing display indicates the RX/TX has not received a range input.

(2) Legend field B - Located at the top right corner, displays, in blue, the range mark interval for the selected range.

(3) Legend field C - Located directly below field A (selected Range). Displays, in blue, mode TEST, WX, TURB or MAP as selected.

(4) Legend field D - Located directly below field B (range mark interval). Displays selected degrees and direction of antenna tilt setting. Stabilization messages are also displayed in this location as follows:

(a) STAB message displayed in blue if, attitude plus tilt setting exceeds excursion limits.

(b) STAB message displayed in yellow if an attitude input failure is detected (INS off or providing invalid pitch and roll signals).

(5) Legend field E - Located directly below field C (selected Mode). Displays COOL, in yellow, when RX/TX experiences cooling fault. Otherwise blank.

(6) Legend field F - Located directly below field D (antenna tilt). Displays CAL in blue or yellow as follows:

(a) CAL displayed in blue, when GAIN control not set to AUTO in MAP mode.

(b) CAL displayed in yellow, when RX/TX receiver is out of calibration.

(7) Legend field G - Located in the centre of the CRT. Displays, in yellow, LRU fault warning. No other legends or data displayed on CRT. Legends displayed may be one or more of the following:

(a) In a normal operating mode (WX, TURB or MAP) RX/TX or ANT.

(b) In TEST mode, RX/TX, ANT, CON, ATT, IND or COOL.

C. When the TEST mode is selected, the entire system is energized. The RX/TX circuits are tested (system transmits very briefly) and then are muted. The antenna scans and a test pattern appears on the indicator.

D. The RX/TX front panel contains an LCD display, which in conjunction with the test pattern and fault messages on the indicator, assist in isolating faulty LRUs.

2. Prepare for Trouble Shooting

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical ground power unit	-
Access platform 13 ft 11 in (4.24m)	-

B. Preliminaries

NOTE: Observe the safe distances described in 34-00-00, Adjustment/Test.

(1) Position controls on radar indicators on panels 1-211 and 1-212 as follows:

(a) Range switch - 20

(b) BRT control midscale

(2) Position switches and controls on weather radar control panel 9-211 as follows:

(a) SYS switch - OFF

(b) TILT - 0 degrees

(c) GAIN - AUTO

(d) Mode selector switch - TEST

(3) Energize the aircraft electrical network (Ref 24-41-00, Servicing).

(4) Provide cooling air to electronic equipment (Ref 21-21-00).

(5) Make certain that the following circuit breakers are set:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATT-INS 1ST PLT SW SUP	1-213	1F 13	G16
ADI 1ST PLT INS1 SUP & IND	2-213	1F 15	B 7
INS1 HTR AND SYS SUP		1F 14	E 6
INS1 HTR SUP		1F 20	F 6
FLT CONT & NAV BUS 14XS		X 355	H 2
No.1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
No.1 WEATHER RADAR IND		1S 32	C 4
PLT'S LT TEST SUP		L1001	E14
ADI 2ND PLT INS2 SUP & IND	13-216	2F 15	C13
INS2 HTR AND SYS SUP		2F 14	D14
No.2 TX RX WEATHER RADAR SUP		2S 30	E18
No.2 WEATHER RADAR IND		2S 32	E19
NAV INST BUS 13XS		X 345	G 4
INS2 HTR SUP		2F 20	G15
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8
ATT INS 2ND PLT SW SUP	15-216	2F 13	D21

(6) On panel 4-211, place Centre Console Panel switch in mid position. The light plates on the WX radar control panel and indicators illuminate.

(7) On panel 2-211, make certain that ATT.INS1/ATT.INS3 switch is placed in ATT.INS1 position.

(8) On panel 2-212, make certain that ATT.INS2/ATT.INS3 switch is placed in ATT.INS2 position.

(9) Put into operation INS1 and INS2 systems (Ref. 34-45-00, Adjustment/Test). Attitude flags on captain's and first officer's ADI should be out of view.

(10) If the antenna is required to be inspected, ensure that the radome is only in a partially extended position (Ref. 53-51-11, Adjustment/Test) so that the scanner may be viewed but not hit the radome or internal equipment when operating. Alternatively, use the scan disable switches on the scanner. Position cable to hold radome open.

3. Fault Finding Tests

NOTE: The following tests may be carried out inside the hangar. The weather radar system must only be operated in test mode.

CAUTION: WHEN AN LRU FAULT WARNING ANNUNCIATOR APPEARS, TURN OFF WEATHER RADAR SYSTEM TO PREVENT FURTHER DAMAGE TO OTHER SYSTEM COMPONENTS.

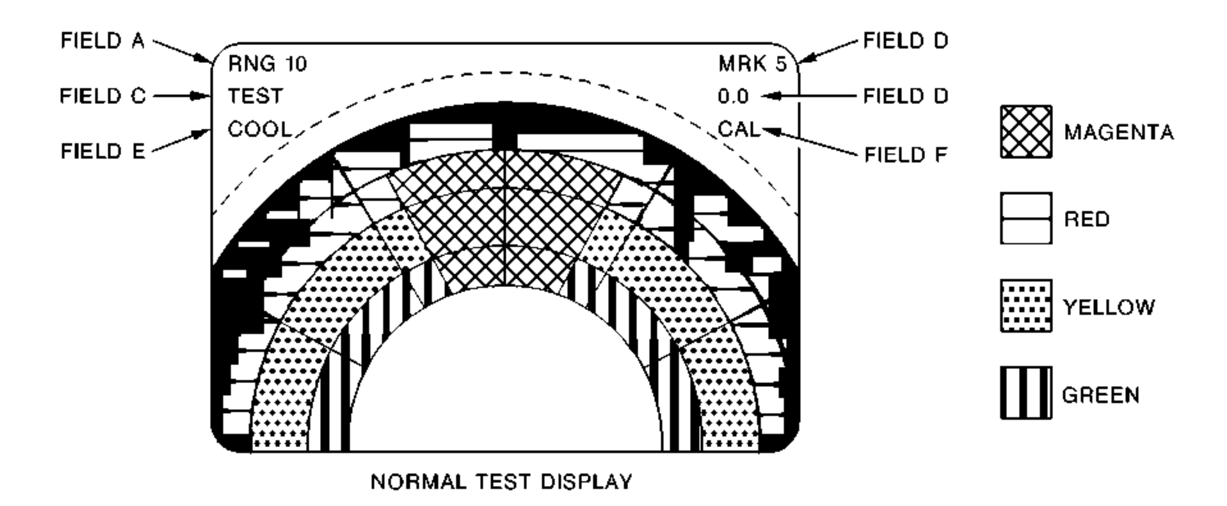
A. On weather radar control panel set SYS switch to 1 or 2. The test pattern should appear similar to test pattern shown in Fig.101 and Fig.102. In event of a fault in a LRU, a fault warning message will be displayed in yellow in the centre of the display. Replace the displayed LRU.

B. If additional fault finding procedures are required to determine the cause of a defect, use the radar RX/TX LCD display described in the next section.

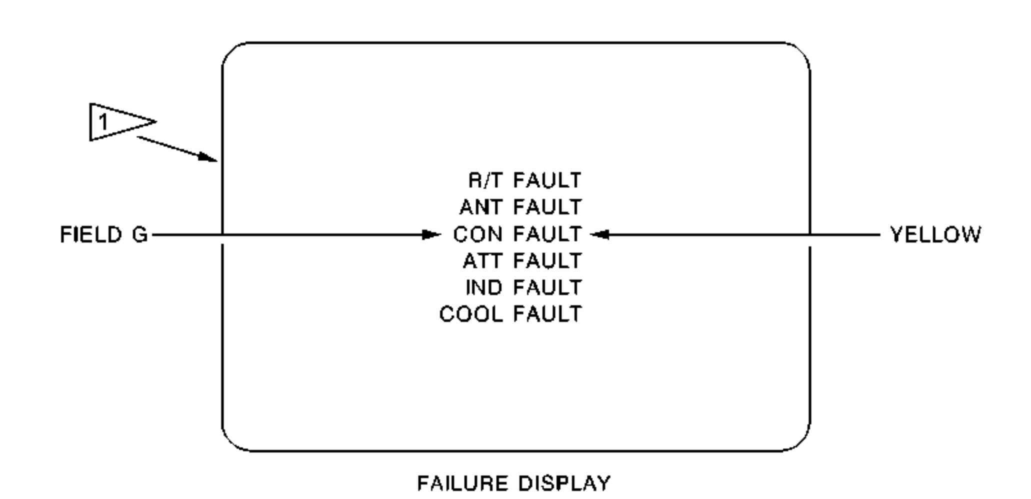
C. System self-test and in-depth fault analysis results can be obtained by using the liquid crystal display (LCD) on the RX/TX front panel. The system monitoring circuits in the RX/TX check and compare selected voltages and signals during each program loop. If these checks or comparisons reveal any abnormality, the LCD memory stores the fault information. Two pushbuttons below the LCD control the sequence of software controlled buttons that result in different functions when pushed. These functions are used to isolate faults in the weather radar system or from inputs to the weather radar. These faults can be seen on the LCD after the RX/TX front panel TEST pushbutton is pushed.

(1) Ensure the preparation procedures in para. 2.B. are followed.

(2) Gain access to the radar RX/TX through door 123 AB and remove radar transceiver compartment cover panel on shelf 29-123.



NORMAL TEST DISPLAY



FAILURE DISPLAY

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CMB 34 41 00 1 AAM0 00

1 AREAS ARE DARK (NO COLOUR) SHOWN REVERSED FOR ILLUSTRATION PURPOSES.

Weather Radar Normal Test and Failure Displays
Figure 101

INDICATOR LEGEND FIELD	MESSAGE - NORMAL DISPLAY	MESSAGE - MALFUNCTION DISPLAY	REPLACE
A	Selected range - '10','20','40','80', '160','320'	Blank display, or a flashing number other than selected range	Indicator
B	Corresponding range mark interval for selected range - '5','10','20','40', '80'	No numbers displayed, or a number not corresponding to selected range	Indicator
C	Selected mode - 'TEST','WX','TURB' or 'MAP'	Blank display	Indicator
D	Antenna tilt setting - '15.0 down through 15.0 up'	'STAB' displayed in yellow	Receiver/Trans-mitter or Trouble shoot inertial navi-gation system (Ref. 34-41-00)
E	Blank Display	'COOL'	RX/TX Cooling fan or Receiver/Trans-mitter
F	Blank Display	'CAL' displayed in blue (GAIN control set to AUTO)	Indicator
		'CAL' displayed in yellow	Receiver/Trans-mitter
G	Blank Display	'R/T'	Receiver/Trans-mitter
		'ANT'	Antenna
		"CON"	Control panel or waveguide switch
		'IND' - When mode selector knob in TEST position	Indicator
		'ATT' - When mode selector knob in TEST position	Trouble shoot inertial navigation system (Ref. 34-45-00)
		'COOL' - When mode selector knob in TEST position	Refer to Field E

Weather Radar Indicator Failure Messages and Faulty LRU
Figure 102

(3) When the LCD TEST pushbutton is pushed a self test is performed the same as using the mode selector switch in the TEST position on the weather radar control panel.
The LCD operates with the TEST pushbutton as follows:

(a) The default menu (main menu) is shown below.

	S	Y	S	T	E	M		C	H	E	C	K	E	R	
					R	T	A	-	4	B					
				S	W		X	X	/	X	X				
t	e	s	t									m	e	n	u

(b) Select the SYS switch on the control panel to the TX/RX under test push the TEST pushbutton. The following display is shown:

						T	E	S	T						
							I	N							
				P	R	O	G	R	E	S	S				

(c) If the SYS switch on the control panel is selected to OFF or to the TX/RX not under test, after about 20 seconds, the LCD display will say RADAR IS OFF. If the SYS switch on the control panel is selected to the TX/RX under test a full test will commence. If no faults are found with the weather radar nor the inputs to the weather radar, the following display is shown below:

R	A	D	A	R			O	K							
I	N	P	U	T	S		O	K							
								p	r	e	v	i	o	u	s

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(d) If weather radar faults are found and no input faults are found the following display is shown below:

R	A	D	A	R			F	A	U	L	T	S			
I	N	P	U	T	S		O	K							
l	i	s	t					p	r	e	v	i	o	u	s

(e) If "list" is selected, the weather radar faults are shown as follows:

R	/	T		F	A	U	L	T							
A	N	T		F	A	U	L	T							
C	O	N		F	A	U	L	T							
m	o	r	e					p	r	e	v	i	o	u	s

(f) Push the "more" pushbutton for additional faults:

W	G		S	W	I	T	C	H		F	A	U	L	T	
I	N	D	I	C	A	T	O	R		F	A	U	L	T	
C	O	O	L	I	N	G		F	A	U	L	T			
m	o	r	e					p	r	e	v	i	o	u	s

(g) If there are no weather radar faults but there are input faults the following display is shown below:

R	A	D	A	R			O	K							
I	N	P	U	T	S		F	A	U	L	T	S			
l	i	s	t					p	r	e	v	i	o	u	s

(h) If "list" is selected, the input faults are shown below:

N	O		A	T	T	I	T	U	D	E		I	N		
m	o	r	e					p	r	e	v	i	o	u	s

(i) Push the "more" pushbutton (if present) for any additional faults.

(4) To interrogate the radar system in greater depth, the LCD operates with the "menu" pushbutton as follows:

(a) The default menu (main menu) is shown below:

	S	Y	S	T	E	M		C	H	E	C	K	E	R	
					R	T	A	-	4	B					
				S	W		X	X	/	X	X				
t	e	s	t									m	e	n	u

(b) The selection of the "menu" pushbutton provides the following options that can be scrolled through on the LCD screen:

Options Menu

→ EXIT TO MAIN
INPUTS
FAULT MEMORY
RESERVED
DATA BASE

b1) After pressing the "menu" pushbutton, the initial display is shown below:

	O	p	t	i	o	n	s		M	e	n	u			
>	E	X	I	T		T	O		M	A	I	N			
	I	N	P	U	T	S									
e	n	t	e	r						s	c	r	o	l	l

b2) The "enter" pushbutton is used to select the EXIT TO MAIN which returns the LCD to the main menu.

b3) The "scroll" pushbutton is used to select the other options for the components of the weather radar system to be interrogated.

(c) If the "scroll" button is pressed to move to INPUTS, and then the "enter" button is pressed, the INPUTS menu has the following options:

Inputs

PREVIOUS MENU
DIGITAL INPUTS
(SUB-OPTIONS:)
(NOTE: All DIGITAL INPUTS SUB-OPTIONS shown with quotation marks are No Data Available/Invalid for the Concorde installation:)
PREVIOUS MENU
"ONSIDE BUS"
"OFFSIDE BUS"
"DADC 1"
"DADC 2"
"DIG RAD ALT 1"
"DIG RAD ALT 2"
EXIT TO MAIN

ANALOG INPUTS
(SUB-OPTIONS:)
(NOTE: All ANALOG INPUTS SUB-OPTIONS shown with quotation marks are Invalid/Not Applicable for the Concorde installation:)
PREVIOUS MENU
ATTITUDE
"HEADING"
"AIRSPEED"
"RAD ALT"
"QUALIFIER"
ANT PROG PINS
"SYSTEM CONF PINS"
"AC PERF PINS"
EXIT TO MAIN

RADAR INPUTS
(SUB-OPTIONS:)
(NOTE: All RADAR INPUTS SUB-OPTIONS shown with quotation marks are Invalid/Not Applicable for the Concorde installation:)
PREVIOUS MENU
"CTRL BUS 0"
CTRL BUS 1
"CTRL BUS 2"
"CTRL BUS 3"
RT ON/OFF
INTERLOCK
EXIT TO MAIN
EXIT TO MAIN

c1) The initial INPUTS display is shown below:

					I	n	p	u	t	s					
>	P	R	E	V	I	O	U	S		M	E	N	U		
	D	I	G	I	T	A	L		I	N	P	U	T	S	
e	n	t	e	r						s	c	r	o	l	l

d) If, for example, the ANALOG INPUTS are to be interrogated, the "scroll" button is pressed to move to ANALOG INPUTS, and then the "enter" button is pressed, the INPUTS menu has the following options:

d1) The initial ANALOG INPUTS display is shown below:

		A	n	a	l	o	g		I	n	p	u	t	s	
>	P	R	E	V	I	O	U	S		M	E	N	U		
	A	T	T	I	T	U	D	E							
e	n	t	e	r						s	c	r	o	l	l

d2) If the "scroll" button is pressed to move to ATTITUDE, and then the "enter" button is pressed, the display is as shown below:

		A	n	a	l	o	g		I	n	p	u	t	s	
	P	I	T	C	H				X	X	X	.	X	°	
	R	O	L	L					X	X	X	.	X	°	
e	x	I	t												

d3) The ATTITUDE display provides the pitch and roll signal inputs to the RX/TX.

d4) If "exit" is selected, the display reverts to the previous screen.

D. Return to the default, or main, menu by scrolling to the PREVIOUS MENU message and then pushing the enter pushbutton. Continue this procedure until the EXIT TO MAIN message is on the LCD display as shown below. Then push the enter pushbutton.

4. System Shutdown Procedures

A. Position the switches and controls on the weather radar control panel as follows.

(1) SYS switch - OFF

(2) TILT control - 0

(3) GAIN - AUTO

(4) Mode selector switch - TEST

B. On weather radar indicator set controls as follows:

(1) BRT - fully counterclockwise

(2) Range switch - STBY

C. Shut down inertial navigation system (Ref. 34-45-00, Adjustment/Test).

D. Remove inertial navigation system cooling (Ref. 21-21-00).

E. If the radar RX/TX compartment cover panel on shelf 29-123 was opened, refit the cover and close access door 123 AB.

F. Remove external electrical power if no longer required (Ref. 24-41-00, Servicing).

G. If the radome was extended, close up and lock (Ref. 53-51-11, Adjustment/Test).

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] Control unit		9-211	S24	Flt. compt.	34-41-12 R/I	34-41-01 34-41-05
[2] Indicator No.1		1-211	1S28	Flt. compt.	34-41-21 R/I	34-41-01
[3] Indicator No.2		1-212	2S28	Flt. compt.	34-41-21 R/I	34-41-05
[4] RX/TX weather radar No.1	door 123 AB	29-123	1S23	Electronics compartment	34-41-33 R/I	34-41-01
[5] RX/TX weather radar No.2	door 123 AB	29-123	2S23	Electronics compartment	34-41-33 R/I	34-41-05
[6] Circuit breaker No.1 TX RX weather radar SUP		13-215	1S30	B4	24-50-00 R/I	34-41-01
[7] Circuit breaker No.2 TX RX weather radar SUP		13-216	2S30	E18	24-50-00 R/I	34-41-05
[8]Circuit breaker No.1 weather radar ind		13-215	1S32	C4	24-50-00 R/I	34-41-01
[9]Circuit breaker No.2 weather radar ind		13-216	2S32	E19	24-50-00 R/I	34-41-05
[10] Antenna		Z113	S25	Nose tip radome	34-41-11 R/I	34-41-01 34-41-05
[11] Transmitter nose position	door 113 DB/ 121 AB	121	M58		27-61-51 R/I	34-41-01 34-41-05

Component Location
Table 101 (continued)

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
[12] Indicator ADI		2-211	1F23	Flt. compt.	34-23-12 R/I	34-45-03
[13] Indicator ADI		2-212	2F23	Flt. compt.	34-23-12 R/I	34-45-03
[14] INU No.1	door 123 BB	27-123	1F8	Electronics compartment	34-45-34 R/I	34-45-00
[15] INU No.2	door 123 BB	27-123	2F8	Electronics compartment	34-45-34 R/I	34-45-00
[16] Waveguide switch	door 123 AZ	29-123	S29	Electronics compartment	34-41-18 R/I	34-41-01 34-41-05
[17] Indicator light - WX RADAR		2-211	1F227	Flt. compt.	34-41-22 R/I	34-41-01 34-41-05
[18] Indicator light - WX RADAR		2-212	2F227	Flt. compt.	34-41-22 R/I	34-41-01 34-41-05

Component Location
Table 101 (concluded)

WEATHER RADAR RDR-4B - ADJUSTMENT/TEST

WARNING: OBSERVE THE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

DO NOT OPERATE WEATHER RADAR WHILE THE AIRCRAFT IS BEING REFUELLED OR DEFUELLED.

DO NOT OPERATE IN ANY RADIATION MODE WHILE A FUEL TANKER IS POSITIONED OR FUELLING OPERATION IS BEING CONDUCTED WITHIN 300 FEET (91.5 m) OF A RADIATING ANTENNA OR AN EXPLOSION MAY OCCUR.

PERSONNEL MUST NOT ENTER AN AREA CLOSER THAN 15 FEET (4.57 m) OF A RADIATING ANTENNA OR INJURY TO PERSONNEL MAY OCCUR.

CAUTION: WHEN AN LRU FAULT WARNING ANNUNCIATOR APPEARS, TURN OFF WEATHER RADAR SYSTEM TO PREVENT FURTHER DAMAGE TO OTHER SYSTEM COMPONENTS.

WHEN THE RADAR IS OPERATED IN ANY MODE OTHER THAN TEST, DIRECT THE NOSE OF THE AIRCRAFT SO THE FORWARD 180-DEGREE SECTOR IS FREE OF LARGE METALLIC OBJECTS (HANGARS, TRUCKS, OTHER AIRCRAFT, ETC.) FOR A DISTANCE OF 300 FEET (91.5 m) AND TILT THE ANTENNA UPWARD 15 DEGREES OR DAMAGE TO RECEIVER MAY OCCUR.

1. General

A. Safe Distances

(1) There are two possible hazards that could result from weather radar ground operation.

(a) Biological affects.

(b) Possibility of fuel vapour explosion.

(2) The first is primarily due to heating of the body tissues and is dependent on average power, and the second is dependent on the production of a spark and is therefore an effect controlled by peak power. There are no internationally accepted figures for the power density levels that produce these effects but a generally accepted set of figures is given below.

(a) Biological Effects.

AVERAGE Power Density (mW/cm^2)	Classification
Above 10	Potentially hazardous.
1-10	Safe for incidental or occasional exposure.
Below 1	Safe for indefinitely prolonged or permanent exposure.

(b) Fuel vapour explosion - Not to exceed $5W/cm^2$.

(3) The scanner under normal conditions is sweeping whenever the transmitter is operating, and therefore a person or object will only be irradiated for a part of the sweep. The average power density at a given point will therefore be less than if the scanner was stationary and this will be taken to be the normal case when considering biological effects.

The safe limit has been calculated using the $1mW/cm^2$ power density classification. A safe limit has also been calculated in the event of a fault in the system such that the scanner remains stationary with the transmitter operating. In this condition the average power density will be much higher and consequently the safe figure quoted for this condition has been calculated using the "occasional exposure" case of $10mW/cm^2$.

(4) The fuel vapour case is concerned with peak power density effect as this is the controlling factor. The figure being the same for stationary and rotating scanner.

(a) Under normal radar operating conditions (i.e., with scanner sweeping) no person must be allowed to be irradiated by the beam within 13 ft (3.96 m) of the scanner.

(b) If the tilt control is set not lower than 8 degrees down no person walking on the ground will be irradiated by the beam (even though he is physically closer to the radome than the figure quoted above). It is therefore recommended that the tilt control is left above 8 degrees down when performing ground checks unless the tilt circuitry itself is being checked.

(c) Under fault conditions (i.e., with radar transmitting and the scanner stationary) the personal hazard distance is increased to 40 ft (12.2 m). It is therefore important not to leave a transmitting radar system unattended.

2. Operational Test

A. The operational test utilises the test mode and other self-test capabilities in the weather radar system to check system performance. When the test mode is selected, transmitter/receiver circuits are tested (system transmits) for 4 seconds and then are muted. A special test pattern is generated and remains on as long as the test mode is selected. By utilisation of the internally generated test pattern, the system is capable of detecting most faults without additional test equipment. See Trouble Shooting section for a more detailed description.

NOTE: The following tests may be carried out inside the hangar. The weather radar system must only be operated in test mode.

B. Equipment and Materials

DESCRIPTION	PART NO.
Electrical ground power unit	-
Access platform 13 ft 11 in (4.24 m)	-

C. Preliminaries

WARNING: OBSERVE THE SAFE DISTANCES DESCRIBED IN 34-00-00, SERVICING.

(1) Position controls on radar indicators on panels 1-211 and 1-212 as follows:

(a) Range switch - 20

(b) BRT control midscale.

(2) Position switches and controls on weather radar control panel 9-211 as follows:

(a) SYS switch - OFF

(b) TILT - 0 degrees

(c) GAIN - AUTO

(d) Mode selector switch - TEST.

(3) Energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(4) Provide cooling air to electronic equipment (Ref. 21-21-00).

(5) Make certain that the following circuit breakers are set:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATT-INS 1ST PLT SW SUP	1-213	1F 13	G16
ADI 1ST PLT INS1 SUP & IND	2-213	1F 15	B 7
INS1 HTR AND SYS SUP		1F 14	E 6
INS1 HTR SUP		1F 20	F 6
FLT CONT & NAV BUS 14XS		X 355	H 2
No.1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
No.1 WEATHER RADAR IND		1S 32	C 4
ADI 2ND PLT INS2 SUP & IND	13-216	2F 15	C13
INS2 HTR AND SYS SUP		2F 14	D14
No.2 TX RX WEATHER RADAR SUP		2S 30	E18
No.2 WEATHER RADAR IND		2S 32	E19
NAV INST BUS 13XS		X 345	G 4
INS2 HTR SUP		2F 20	G15
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8
PLT'S LT TEST SUP	15-215	L1001	E14
ATT INS 2ND PLT SW SUP	15-216	2F 13	D21

(6) On panel 4-211, place centre console panel switch in mid position. The light plates on the WX radar control panel and indicators illuminate.

(7) On panel 2-211, make certain that ATT.INS1/ATT.INS3 switch is placed in ATT.INS1 position.

(8) On panel 2-212, make certain that ATT.INS2/ATT.INS3 switch is placed in ATT.INS2 position.

(9) Put into operation INS1 and INS2 systems (Ref. 34-45-00 Adjustment/Test). Attitude flags on Captain's and First Officer's ADI should be out of view.

D. Operational Test Procedure

CAUTION: WHEN AN LRU FAULT WARNING ANNUNCIATOR APPEARS, TURN OFF WEATHER RADAR SYSTEM TO PREVENT FURTHER DAMAGE TO OTHER SYSTEM COMPONENTS.

(1) On weather radar control panel set SYS switch to 1. The test pattern should appear similar to test pattern shown in Trouble Shooting Fig.101 and Fig.102. In the event of a fault in a line replaceable unit (LRU), a fault warning message will be displayed in yellow in the centre of the display. Replace the displayed LRU.

(a) Test pattern on indicator displays three colour bands, green at the bottom, yellow middle, red at top and a magenta wedge in the centre. The size of each colour band is not critical.

(b) Azimuth lines, range marks and alphanumeric messages should be displayed steadily in blue.

(2) Rotate BRT control on each indicator. Check intensity of range marks, azimuth lines, numerics and test pattern changes as control is rotated.

(3) Position range switch on each indicator to each range selection in succession. Check appropriate range marks and numerics appear with each selection.

NOTE: Test pattern stays the same for all ranges, since the colour bands are not related to distance but rather to relative position on the display.

(a) Range 10, marks displayed 2, mark interval 5

(b) Range 20, marks displayed 4, mark interval 5

(c) Range 40, marks displayed 4, mark interval 10

(d) Range 80, marks displayed 4, mark interval 20

(e) Range 160, marks displayed 4, mark interval 40

(f) Range 320, marks displayed 4, mark interval 80.

(4) Rotate TILT control above and below zero. Check indicator tilt message changes with tilt control setting.

(5) Return TILT control to 0 position.

(6) Rotate GAIN control out of AUTO detent position. Check CAL message is displayed in blue, directly below TEST on indicator CRT.

(7) Return GAIN control to AUTO position. Check CAL message is no longer displayed.

(8) Check that indicator sweep trace is scanning smoothly between 90 ±3 degrees left and 90 ±3 degrees right of dead ahead, for DAA-4A in approximately four seconds. The sweep on all indicators in the system should be synchronised.

(9) Place INU 1 MSU switch on the Flight Engineer's panel to OFF. Check for the following:

(a) That the scanner is scanning and, after 5 seconds, the screen on each weather radar display has an "ATT FAULT" message in the middle of a blank background. Also, an "EXT PWS FAULT" message along with the "ATT FAULT" may be present.

NOTE: This predictive windshear (PWS) message is a nuisance message which will be deleted at a later software revision of the RX/TX and is only of importance if it occurs in any mode apart from the specified TEST mode.

(10) Place SYS switch to 2 and repeat operational test for system 2.

(11) Place SYS switch to OFF if no further testing is required.

(12) If no further tests are required, perform Weather Radar System Shutdown Procedure.

3. System Test

A. Stabilization tests are provided in the system test. The test uses an INU simulator to verify proper system operation. In addition, a stabilization test utilizing the self-test features of the weather radar system may be performed during the weather radar system operational test.

The system test procedures consist of the following individual tests:

(1) Fan Operation Check.

(2) Operational Test.

(3) Stabilization Test.

(4) Nose Droop Tests.

(5) Pressure Sealing Tests.

NOTE: The following tests may be carried out inside the hangar. The weather radar system must only be operated in test mode.

WARNING: OBSERVE THE SAFE DISTANCES DESCRIBED IN 34-00-00, SERVICING.

B. Equipment and Materials

DESCRIPTION	PART NO.
Electrical ground power unit	-
Access platform 13 ft 11 in (4.24m)	-
INU Simulator comprising:	
Attitude Control Unit (ACU)	22-1141SHT1
Master Interface Unit (MIU)	22-1141SHT9

C. Preliminaries

(1) Perform the Preliminaries detailed in para. 2.C.

(2) As the antenna is required to be inspected, ensure that the radome is only in a partially extended position (Ref. 53-51-11, Adjustment/Test) so that the scanner may be viewed but not hit the radome or internal equipment when operating. Alternatively, use the scan disable switches on the scanner. Position cable to hold radome open.

D. System Test Procedure

(1) Perform the Operational Test Procedure in para. 2.D.

(a) Observe all instructions, cautions and warnings in the operational test.

(2) Gain access to the radar transceivers through door 123AB and remove radar transceiver compartment cover panel on shelf 29-123.

(a) Place Mode select switch to TEST and SYS switch to 1 on radar control panel. Check for the following:

- At weather radar bay, radar transceiver No.1 mount cooling fan should be operating.

(b) Place SYS switch to 2. Check for the following:

- At weather radar bay, radar transceiver No.2 mount cooling fan should be operating.

(3) Ensure that INS1 and INS2 systems are off.

(4) Stabilization Test using INS Simulator

(a) Description

The INS simulator consists of two units, a Master Interface Unit (MIU) which replaces the NAV Unit in the INS rack and an Attitude Control Unit (ACU). By unclipping the front panel of the MIU access is gained to an umbilical loom which has sufficient length to reach the flight deck, this loom is plugged into the ACU.

The ACU consists of the following:

- POWER SWITCH AND WARNING LAMPS - power is connected to the simulator by making the appropriate INS 115V ac circuit breaker, when the ACU power switch is placed to ON five warning lights will illuminate.
- PITCH/ROLL SELECT switch - determines the designation of the selected input signal (angle).
- PITCH/ROLL ANGLE selector - sets the magnitude and sign of the input signal to be injected into the aircraft system.
- PITCH/ROLL RATE selector - determines the rate at which the input signal will increase until it reaches the magnitude determined by the PITCH/ROLL selector.
- ANGLE/RATE switch - when put to "SET-UP" allows the ANGLE and RATE selectors to be pre-set. When the switch is put to INJECT the input signal increases to the desired level at the pre-set rate.
- HEADING - enables the heading to be increased or decreased but is not modified by a rate function. This simulates rotating the D.G.

- METER MODE SWITCH AND METER - when the meter mode switch is monitoring output 1 and 3 or 2 and 4 the meter indicates the input signal to the aircraft system, the input signal will not be indicated when the switch is selected to EXT TEST. It is important to remember that this is essentially a test facility and the meter is not an accurate measure of signal level whereas the angle set on the PITCH/ROLL ANGLE selector is accurate.
- INJECT switch - see ANGLE/RATE above.
- CVG switch - Set to CVG for most applications.

(b) Radar Stabilization Test

To check that the RDR-4B radar stabilization works correctly, use the INU simulator test set and follow the instructions below. Check that correct roll and pitch command corrections are displayed by the antenna and that STAB messages are displayed on the indicators when antenna stabilization limits are exceeded.
Select the INS Simulator in No.1 position and weather radar system No.1 first.

(c) Set Up

c1) Set ACU power/on switch to OFF.

CAUTION: BEFORE REMOVING INU No.1 OR INU No.2, TURN OFF POWER AND ALLOW APPROXIMATELY 15 MINUTES FOR GYROS TO COAST DOWN. IF UNITS ARE REMOVED TOO SOON, GYROSCOPIC PRECESSION COULD RESULT IN DAMAGE.

c2) Ensure INU No.1 and No.2 MSU is OFF and INS CBs are pulled. Remove Nav units 1 and 2 (Ref. 34-45-34, Removal/Installation).

c3) Attach umbilical loom to the ACU and connect to aircraft by plugging in master interface unit in place of selected INU. A/C cooling needs to be on otherwise INU cooling horn will sound.

c4) Set INS CBs.

c5) When INU power is applied, the 747/CONC lamp on the ACU should illuminate and the warn lamp on the selected INU CDU is displayed.

c6) On ACU:

- Set PITCH/ROLL SELECT switch to required test axis.
- Set PITCH/ROLL ANGLE selector to 0 degrees.
- Set METER MODE SWITCH AND METER to monitor O/P 1+3.
- Set INJECT switch to INJECT.
- Set CVG switch to CVG (OFF).
- PITCH/ROLL RATE selector to MAX.
- HEADING to 0 degrees.
- Set ACU power/on switch to ON.
- Ensure that all lamps on the bottom left of the ACU are on.

c7) On weather radar system:

- Ensure that power is on.
- Set control panel mode select switch to TEST.
- Set control panel tilt switch to 0 degrees.
- Select required WX radar system No.1 or No.2 to ON.
- Check that the test pattern is displayed and the scanner scans.

(d) Radar Stabilisation Test Procedure

d1) Pitch stability sense check

- Set PITCH/ROLL SELECT switch to PITCH and vary the PITCH ANGLE selector to any required angle and ensure that the scanner responds in the appropriate sense e.g. if the selector is moved to a pitch up command of 30 degrees, then the antenna at its centre position, will point at angle of 30 degrees down minus the nose droop angle setting. The antenna will point at 0 degrees at each end of its scan.
- Vary the tilt control on the WX radar control panel and check that this adds or subtracts a pitch input across the whole scan of the antenna.

d2) Pitch stability limits check

NOTE: STAB limits are complex due to droop nose inputs but, in general, if the combination of pitch, nose droop and tilt inputs totals above 42 degrees, a stabilisation error message will be produced.

- Set PITCH/ROLL SELECT switch to PITCH and set the PITCH ANGLE selector to 35 degrees pitch down.
- Set the tilt knob on the control panel to plus fifteen degrees and ensure that a blue STAB message is displayed on the PPI as the scanner scans.
- Set the tilt knob on the control panel to 0 degrees and ensure that no blue STAB message is displayed on the PPI as the scanner scans.

NOTE: The nose droop provides a negative input to the RX/TX which is then subtracted from the aircraft pitch input from the INU which is negative on pitch down and positive on pitch up. For example, if the nose was down 5 degrees and the aircraft was pitching up 5 degrees, the resultant calculation by the RX/TX would be 0 degrees and an antenna position of 0 degrees. Another example is, if the nose was down 12.5 degrees and the aircraft was pitching down 22.5 degrees, the resultant calculation by the RX/TX would be minus 35 degrees and an antenna position of 35 degrees pointing up.
A STAB message is only obtained when the antenna position exceeds ±42 degrees. Thus, as a further example, if the nose is at 0 degrees and the aircraft pitch simulator input is at 35 degrees pitch down (i.e. the antenna would be at position of 35 degrees pointing up), a STAB message would only be seen when the tilt control was above +7.5 degrees.

d3) Roll stability sense check

- Set PITCH/ROLL SELECT switch to ROLL and vary the ROLL ANGLE selector to any required angle and ensure that the scanner responds in the appropriate sense e.g. if the selector is moved to a left roll command of 30 degrees, then the antenna, will point 30 degrees high on the port side and 30 degrees low on the starboard side. The droop nose angle will complicate the scan path but simplistically, a nose droop angle setting lower than 0 degrees will add a point up command to the antenna mainly at the straight ahead centre position.

d4) Roll stability limits check

- Set PITCH/ROLL SELECT switch to ROLL and set the ROLL ANGLE selector to 35 degrees LEFT ROLL.
- Set the tilt knob on the control panel to +8 degrees and ensure that a blue STAB message is displayed on the PPI as the antenna meets its port end stop. (The scan line on the PPI shows the antenna position).
- Set the tilt knob on the control panel to -8 degrees and ensure that a blue STAB message is displayed on the PPI as the antenna meets its starboard end stop. (The scan line on the PPI shows the antenna position).
- Set the tilt knob on the control panel to 0 degrees and ensure that no blue STAB message is displayed on the PPI as the scanner scans.

NOTE: A STAB message is only obtained when the antenna position exceeds ±42 degrees. As the STAB message only occurs towards the ends of the scan, any pitch input has no effect on when the STAB message is produced as pitch commands are maximum at the dead-ahead centre position and taper out at each end of the scan.

(e) After STAB test refit INUs, close up INU compartment and confirm that INS No.1 and 2 are operating satisfactorily (Ref. 34-45-34, Removal/Installation). Leave No.1 and No.2 INUs and cooling system operating for the nose droop test below.

(5) Test the Droop Nose Compensation for WX radar systems 1 and 2 in TEST Mode:

(a) On the antenna drive unit, undo the lock out screw and select the azimuth scan disable switch.

(b) For WX radar systems 1 and 2, place the droop nose in the 0 degree position (Ref. 27-61-00, Adjustment/Test) and check that the antenna is at 0 degree (antenna horizontal). Manually position antenna at 0 degree azimuth position (straight ahead).

(c) For WX radar systems 1 and 2, place droop nose in the 12.5 degrees position and check that the antenna is still horizontal and that the angle read on the graduated scale is 12.5 ±2.5 degrees.

(d) On the antenna drive, place the azimuth scan disable switch to scan so that the antenna scans.

(e) For WX radar systems 1 and 2, check that indicator sweep trace is scanning smoothly between 90 ±3 degrees left and 90 ±3 degrees right of dead ahead, for DAA-4A in approximately four seconds. The sweep on all indicators in the system should be synchronised.

(f) Observe that as the antenna sweeps from right-to-left, the sweep on the indicator is moving in the same direction.

(g) Place SYS switch on the WX radar control panel to OFF if no further testing is required.

(h) Lock out the azimuth scan disable switch with the previously removed screw.

(i) Perform a Waveguide Sealing Test Ref. para. (6).

(j) If no further tests are required, perform Weather Radar System Shutdown Procedure in accordance with the procedure in para. 2.D.

(6) Waveguide Sealing

NOTE: The following measurement procedure is given for information. It can only be used following a Removal/Installation of the weather radar antenna or part of the waveguide or as part of a test.

If a high precision flow-meter is available, the leak test is carried out by a check of flow. If not, use values given by the elassic method, that is, by pressure drop in a given period.

(a) Equipment and Materials

DESCRIPTION	PART NO.
Bottle of Nitrogen, fitted with	-
pressure reducing valve limiting pressure to 1000 mb (14.5 psi)	-
Nitrogen line with shut-off valve	-
Flowmeter - if available	-
Pressure gauge graduated from 0 to 1000 mb (14.5 psi) with T-union	-
Connection line with dessicator bottle	-
Adapter, local manufacture	-
Waveguide blanking cover	-
Stop watch	-

(b) Prepare (Ref. Fig.501)

NOTE: If the measurement is made with the antenna connected, do not carry out operations in para. (1) and (2).

b1) If necessary open radome (Ref. 53-51-11, Servicing) and position securing cable.

b2) On the antenna:

- Lift cover on antenna support and place Scan Disable switch in up position.
- By means of quick disconnect fastener, disconnect aircraft waveguide from antenna input.
- On disconnected waveguide (Point A) fit blanking cover.

b3) Disconnect and remove dessicator bottle (Ref. 34-41-60 Removal/Installation).

b4) Connect line including dessicator adapter to aircraft pressurization line (Point B).

b5) Connect dessicator adapter line to pressure gauge T-union output. Insert flowmeter if used.

b6) Connect line including shut off valve to pressure gauge T-union input.

b7) Connect shut off valve line to pressure reducing valve.

(c) Tests

c1) Open shut-off valve and bring pressure to 738 mb (10.7 psi) reading on pressure gauge, by means of pressure reducing valve.

c2) Stabilize system pressure at this value, close shut off valve and start stop-watch.

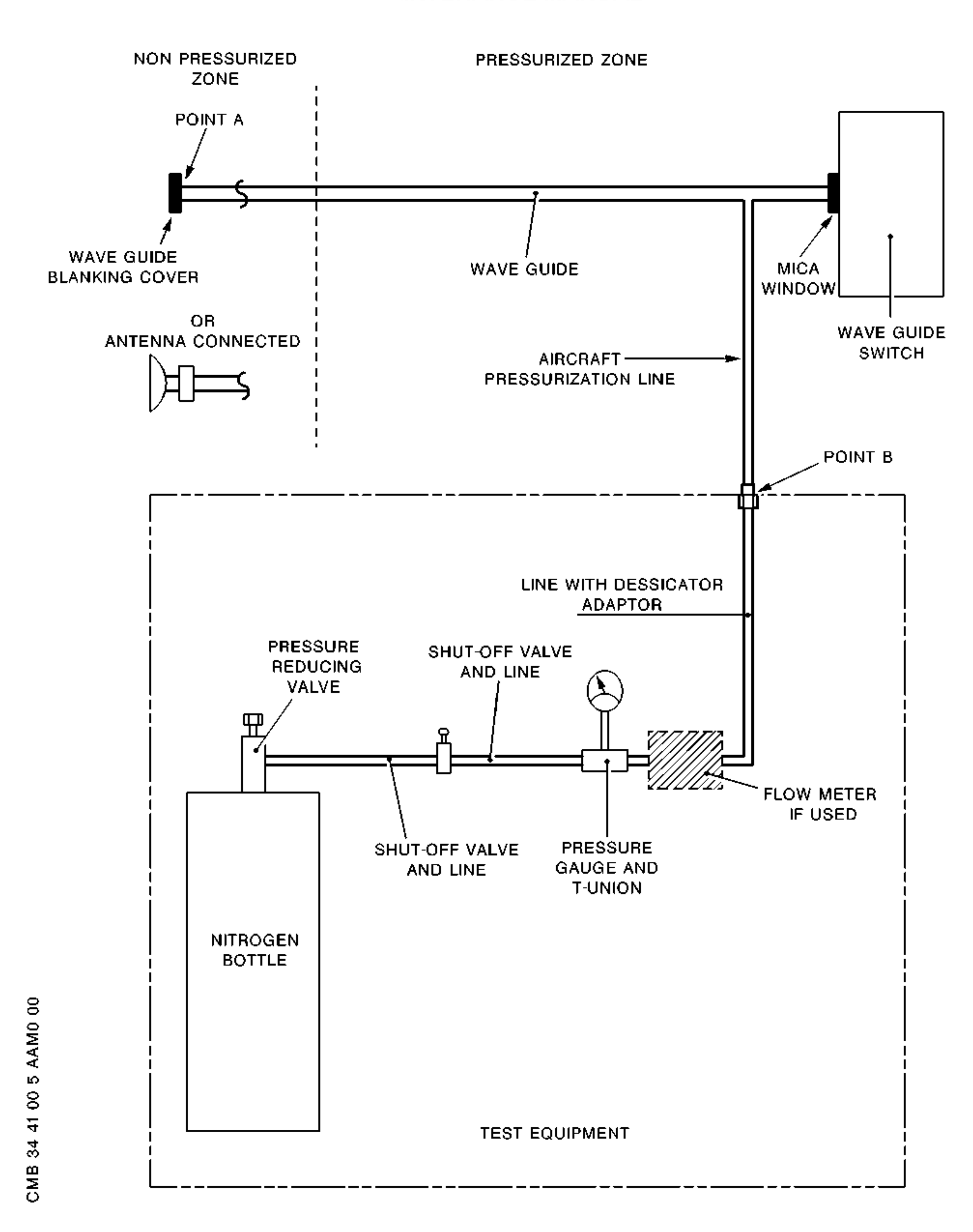
c3) To measure pressure drop, stop the stop-watch after 30 seconds and check:

- Measurement with antenna disconnected:
  That pressure gauge indicates approximately 718 mb (10.41 psi)
  (Tolerated pressure drop is 20 mb (0.29 psi))

- Measurement with antenna connected (Ref. Note para. 5.B.).
  That pressure gauge indicates approximately 538 mb (7.80 psi)
  (Tolerated pressure drop is 200 mb (2.90 psi)).

c4) Leakage Measurement (if used)

- Measurement with antenna disconnected:
  Check on flowmeter that leakage in waveguide assembly is less than 100 cm^3/minute.
- Measurement with antenna connected (Ref. Note in para. 5.B.).
- Check on flowmeter that leakage in waveguide assembly is less than 1500 cm^3 minute.



Waveguide Pressurization -
Test Equipment Assembly
Figure 501

(d) Close-Up

d1) Close pressure release on pressure reducing valve.

d2) Disconnect aircraft pressurization line from dessïcator adapter line (Point B).

d3) Install dessicator bottle after check of dessicator (Ref. 34-41-60, Removal/Installation and Servicing).

d4) Disconnect and remove test equipment.

(e) On antenna (if check was made with antenna disconnected).

e1) Remove waveguide blanking cover and connect aircraft waveguide to antenna input by means of quick disconnect fastener.

e2) Place scan disable switch in down position, lower cover.

e3) Close radome (Ref. 53-51-11, Servicing), if necessary.

WEATHER RADAR SYSTEM RDR-4B - CLEANING/PAINTING

1. General

A. This procedure provides for cleaning the weather radar transceiver mount filters. One filter is installed in a filter assembly on each of the dual transceiver mount sections. The dual mount is located on shelf 29-123 in the forward underfloor compartment.

2. Filter Cleaning

NOTE: As both filters are identically installed, only one cleaning procedure is described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Detergent soap	-
Hot water	-
Circuit breaker safety clips	-

B. Prepare

(1) On centre console 9-211, on weather radar control panel, make certain that the radar is selected to OFF.

(2) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
No2 TX RX WEATHER RADAR SUP	13-216	2S 30	E18

(3) Open access door 123 AB and remove protective panel from shelf 29-123.

C. Remove

(1) Loosen the knurled screws attaching the filter assembly to the transceiver mount.

(2) Remove the filter retainer and filter assembly.

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D. Clean

(1) Wash the filter in a container of detergent soap and hot water.

(2) Dry the filter by blowing out all moisture with clean, dry compressed air at a pressure of between 25 to 38 (maximum) psi (1.72 to 2.62 bar).

E. Install

(1) Install the filter and retainer into the transceiver mount and secure with the knurled screws.

F. Close-Up

(1) Remove safety clips and tags and reset the circuit breakers tripped in para. 2.B.(2).

(2) Refit the protective panel on shelf 29-123.

(3) Close underfloor access door 123 AB.

END OF THIS SECTION

NEXT

WEATHER RADAR ANTENNA - REMOVAL/INSTALLATION

1. General

The weather radar assembly (S25) is located in zone 111, in the radome.

2. Weather Radar Antenna

A. Equipment and Materials

DESCRIPTION	PART NO.
Access platform, 13 ft 11 in (4.24 m)	-
Wave guide blanking caps (2 off)	-
Electrical connector blanking caps (4 off)	-
Circuit breaker safety clips	-

B. Prepare

(1) On centre console 9-211, on weather radar control unit, ensure that the controls are in the following positions:

R (a) Radar SYS 1-OFF-2 switch is in OFF position.

(b) TILT knob in 0 position.

R (c) Mode selector switch is in the TEST position.

R

(2) On LH and RH side consoles (1-211 and 1-212) ensure that on
R radar indicators, range selector switch is in the STBY
R position.

(3) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STBY PITOT HTR IND	1-213	H 122	J10
STBY PITOT HTR SUP	2-213	H 121	F18
NO 1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
NO 1 WEATHER RADAR IND		1S 32	C 4
NO 2 TX RX WEATHER RADAR SUP	13-216	2S 30	E18
NO 2 WEATHER RADAR IND		2S 32	E19

WARNING: THE WEATHER RADAR ANTENNA ASSEMBLY WEIGHS
R APPROXIMATELY 14 Kgs (30.5 lbs) AND CONSEQUENTLY REQUIRES TWO PERSONS FOR REMOVAL AND INSTALLATION.

HANDLE THE ASSEMBLY WITH CARE IN ORDER TO AVOID INJURY TO PERSONNEL OR DAMAGE TO MECHANICAL PARTS OR REFLECTOR.

(4) Place, or ensure that droop nose is placed in zero position (Ref. 27-61-00, Adjustment/Test).

(5) Position access platform.

(6) Open radome and slide it along its rails (Ref. 53-51-11, Servicing).

R
R
R C. Remove (Ref. Fig.401)
R
R (1) Disconnect from rear of antenna assembly electrical connectors (7) with red and green identifiers, then install four blanking caps in place of connectors.

R (2) Disconnect aircraft waveguide (3) from antenna assembly by means of quick attach/disconnect (QAD) connector (4) and install blanking caps on waveguide.

R (3) Loosen and remove the two lower self-locking nuts (9),
R remove washers (10) and lower attachment bolts (6).

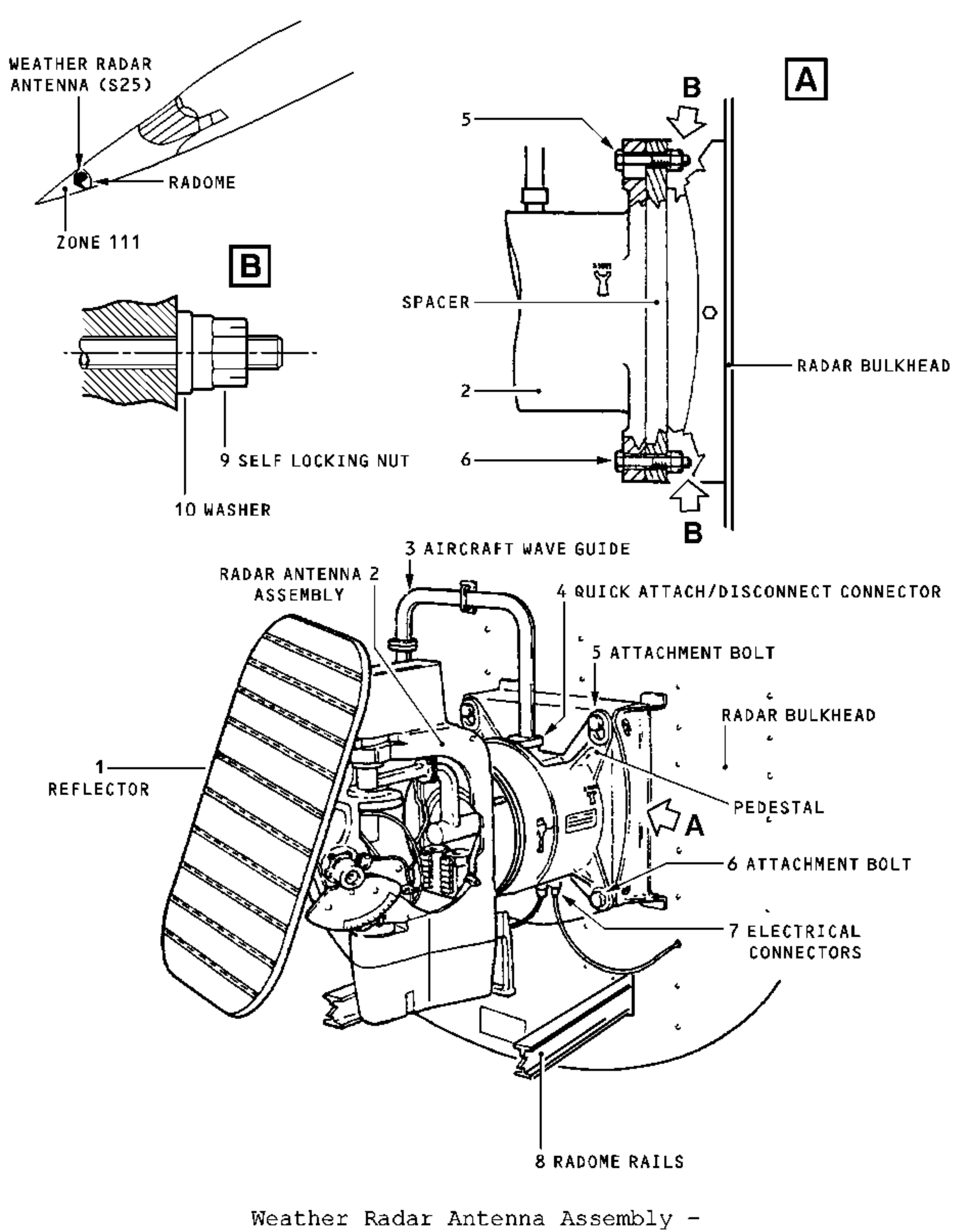
R (4) Loosen, without removing, the two upper self-locking
R nuts (9). Support antenna radar assembly (2) so as to allow release of upper attachment bolt (5) heads through slotted holes.

R (5) Remove antenna radar assembly (2) turning reflector (1) so as to allow it to pass between radome rails.

R (6) Remove the two upper self-locking nuts (9) washers (10) and attachment bolts (5).

R (7) Discard the four self-locking nuts (9).

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R Weather Radar Antenna Assembly -
R Removal/Installation
R Figure 401

D. Preparation of Replacement Component

(1) On aircraft ensure that attachment surfaces are clean.

(2) On radar antenna assembly ensure:

(a) By a visual check, that pedestal (Ref. Fig.401) is in good condition (absence of cracks and scratches). Check that reflector is in good condition.

(b) That electrical connector pins are undamaged.

(c) That antenna assembly moves freely around its axes when manually manipulated.

R
R E. Install (Ref. Fig.401)

NOTE: The attachment bolts are of different length. The two longest bolts fit the lower holes and the two shortest the upper holes.

R (1) Place attachment bolts (5) with the washer (10) and self-
R locking nut (9) in upper aircraft support holes, without tightening them.

(2) Turn reflector (1) to allow it to pass between radome rails (8). Position antenna assembly with upper holes facing their attachment bolts (5).

(3) Lower antenna radar assembly until upper attachment bolts (5) are engaged.

R (4) Install two lower attachment bolts (6) with washer (10) and
R self-locking nut (9).

(5) Tighten bolts (5) and (6) and torque-tighten to between 280 and 320 lbf in (3.16 and 3.61 mdaN).

(6) Remove waveguide blanking caps and connect aircraft waveguide (3) to radar antenna assembly by means of QAD connector (4).

(7) Remove blanking caps from electrical connectors (7) and connect aircraft connectors to antenna connectors according to coloured identifiers.

R
F. Test

(1) Carry out a test of antenna (Ref. Adjustment/Test).

WEATHER RADAR ANTENNA - ADJUSTMENT/TEST

1. Tests

A. Sealing Test

(1) Carry out a waveguide sealing test (Ref. 34-41-00, Adjustment/Test).

NOTE: Measurement is made with antenna connected.

B. Antenna Test

(1) With radome in the forward position on its rails, install cable to hold open radome.

(2) Remove safety clips and tags and reset the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NO 1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
NO 1 WEATHER RADAR IND		1S 32	C 4
NO 2 TX RX WEATHER RADAR SUP	13-216	2S 30	E18
NO 2 WEATHER RADAR IND		2S 32	E19
NAV INST BUS 13XS		X 345	G 4

(3) Carry out work preparation for weather radar operational test (Ref. 34-41-00, Adjustment/Test).

(4) On centre console 9-211, on weather radar control unit:

R - select radar SYS 1-OFF-2 switch to No.1.
R - select TEST on mode selector switch.
- place TILT knob to 0 position.

(5) On LH and RH side consoles (1-211 and 1-212) on radar indicators:

R - select any range, i.e. take range selector switch out
R of STBY.

R (6) Carry out an Operational Test of the weather radar system
R (Ref. 34-41-00, Adjustment/Test).

(7) Check that antenna:

- sweeps approximately a 180° sector.
- is approximately in a horizontal position.

R (8) Ensure scanner disable switch is locked in enable position.

(9) On radar control unit, select tilt angle 14° UP and read an
R angle of 14° up on antenna tilt scale. Also ensure that 14°
R up is shown on the weather radar display.

(10) On radar control unit, select tilt angle 14° DN and read an
R angle of 14° down on antenna tilt scale. Also ensure that
R 14° down is shown on weather radar display.

(11) On radar control unit:

- select tilt angle 0° and read 0° on antenna tilt scale.
R Also ensure that 0° is shown on the weather radar display.
R - select SYS 1-OFF-2 switch to OFF.

(12) Manually move antenna upwards or downwards so as to read on antenna scale an angle of 20° up or down.

(13) Manually move antenna so as to read 40° on roll scale.

R (14) On radar control unit, select TEST on mode select switch and
R select No.1 on SYS 1-OFF-2 switch:

- roll scale indicates original position (approximately 0°).
- tilt scale indicates original position (approximately 0°).

R (15) On radar control unit, place radar SYS 1-OFF-2 switch to
R No.2 and repeat steps (7) to (14) inclusive.

R (16) On radar control unit, place radar SYS 1-OFF-2 switch
R to OFF.
R
R (17) On LH and RH side consoles (1-211 and 1-212), on radar
R indicators, place range selector switch to STBY position.

R (18) On Flight Engineer panel, on panel 8-214, place MSU selector switch (INS1 and INS2) in OFF position.

R (19) Trip the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NO 1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
NO 1 WEATHER RADAR IND		1S 32	C 4
NO 2 TX RX WEATHER RADAR SUP	13-216	2S 30	E18
NO 2 WEATHER RADAR IND		2S 32	E19
NAV INST BUS 13XS		X 345	G 4

C. Close-Up

(1) Remove cable holding radome open.

(2) Close radome (Ref. 53-51-11, Servicing).

(3) Remove access platform.

(4) Set the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STBY PITOT HTR IND	1-213	H 122	J10
STBY PITOT SUP	2-213	H 121	F18

(5) Carry out nose probe heating test (Ref. 30-31-00, Adjustment/Test).

(6) Trip the circuit breakers set in step (4).

(7) Switch off electronics rack ventilation system (Ref. 21-21-00, Servicing).

(8) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

R WEATHER RADAR RDR-4B CONTROL PANEL - REMOVAL/INSTALLATION

1. General

Weather radar control panel (S24) is located on centre console 9-211.

2. Weather Radar Control Panel

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Blanking plugs/caps	-

B. Prepare

(1) On overhead panel 4-211, make certain that CENTRE CONSOLE PANEL switch is in OFF position.

(2) On weather radar control panel, on centre console 9-211,
R make certain that on the SYS select switch OFF is selected.

(3) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NO 1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
NO 1 WEATHER RADAR IND		1S 32	C 4
NO 2 TX RX WEATHER RADAR SUP	13-216	2S 30	E18
NO 2 WEATHER RADAR IND		2S 32	E19
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8

C. Remove

(1) Refer to 34-00-00, Removal/Installation, para. 3.D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, para. 3.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, para. 3.F.

F. Close-Up

(1) Remove safety clips and tags and reset the circuit breakers tripped in para. 2.B.(1).

(2) Carry out an operational test of the relevant system (Ref. 34-41-00, Adjustment/Test).

WAVEGUIDE SWITCH - REMOVAL/INSTALLATION

1. General (Ref. Fig.401)

Waveguide switch S29 is in zone 123 on shelf 29-123. To gain access to this device, transceivers 1S23 and 2S23 and shelf 29-123 must be removed.

R If waveguide switch is confirmed as failed then the complete tray
R assembly should be changed. If tray assembly is not available then
R waveguide switch is to be changed as per the following procedure.

2. Waveguide Switch S29

A. Equipment and Materials

DESCRIPTION	PART NO.
Access platform, height 11 ft 4 in (3.47 m)	-
Lockwire 0.032 in (0.8 mm) (corrosion resistant steel) (Ref 20-21-13)	-
Circuit breaker safety clips	-

B. Prepare

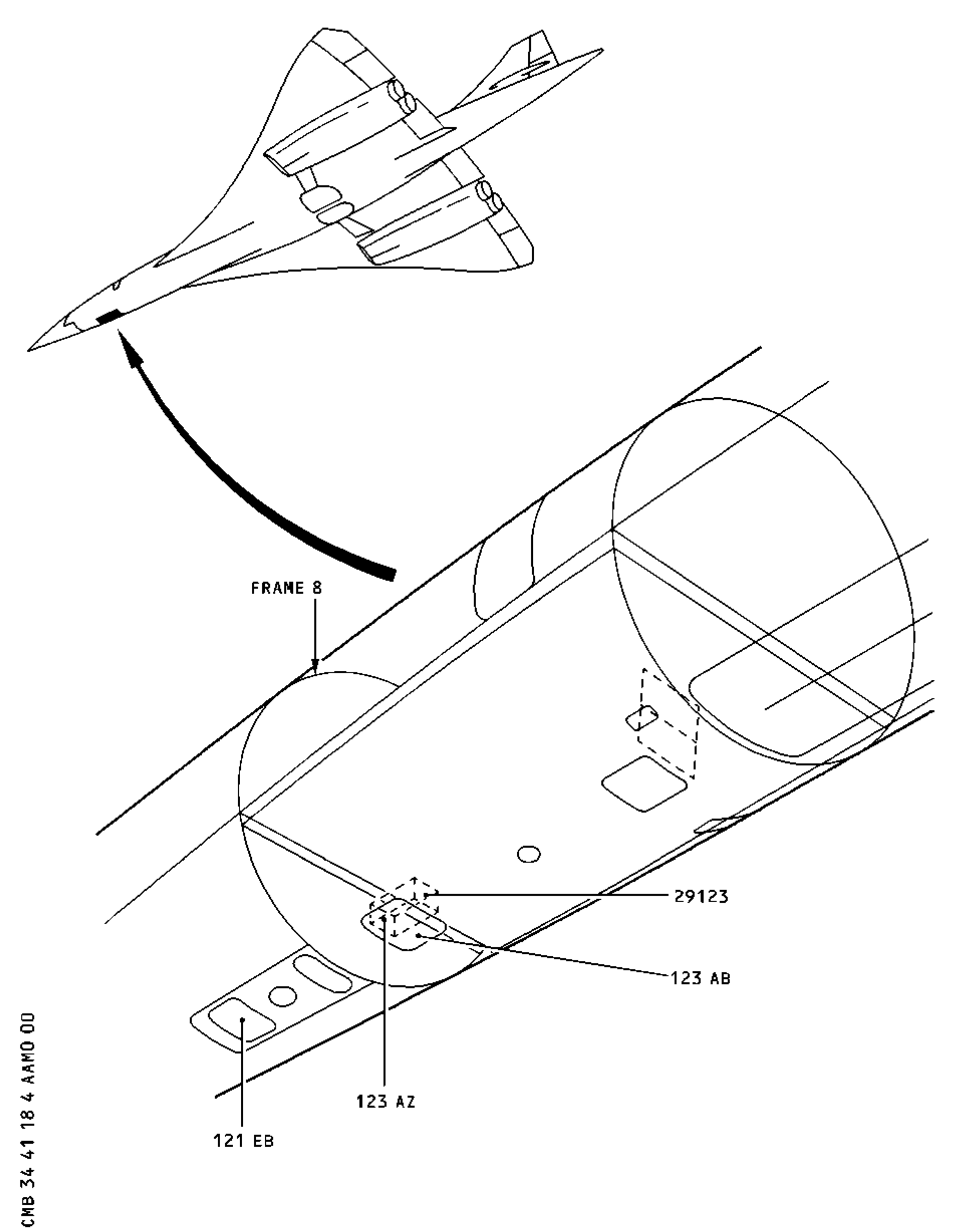
(1) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NO 1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
NO 1 WEATHER RADAR IND		1S 32	C 4
NO 2 TX RX WEATHER RADAR SUP	13-216	2S 30	E18
NO 2 WEATHER RADAR IND		2S 32	E19

(2) In zone 121 position access platform.

(3) Open access door 121 EB.

(4) In forward compartment, zone 121, at frame 8 on flexible partition between zones 121-123, gain access by opening fastener.



Shelf 29-123 Housing
Figure 401

(5) In zone 123 position access platform.

(6) Open access door 123 AB.

(7) In forward compartment, zone 123, open door 123 AZ.

C. Removal of Shelf 29-123 (Ref. Fig.402)

(1) In forward compartment, zone 121 at frame 8, gaining access through opening in flexible partition, remove four waveguide mounting screws (5). Retain washers (6).

(2) In forward compartment, zone 123 on shelf 29-123, remove weather radar transceivers 1S23 and 2S23 (Ref. 34-00-00, Removal/Installation.

(3) In shelf 29-123 housing, disconnect and cap connectors 1S33, U2131, U2136, U2133, 2S33, U2132, U2135 and U2134.

(4) Remove grounding strap (2) securing screw (3).

(5) Loosen retaining nut (1) and release studs.

(6) Loosen and remove the four shelf mounting screws (4).

(7) Carefully pull shelf so as to disengage from guide rails (7).

(8) Remove shelf from forward compartment, zone 123.

<u>WARNING</u>: BECAUSE OF THE DIMENSIONS OF SHELF 29-123 AND ACCESS DOOR 123 EB, IT IS NECESSARY TO TAKE PRECAUTIONS IN ORDER TO PROTECT BOTH OPERATOR AND EQUIPMENT. ENSURE THAT ELECTRICAL CONNECTORS ARE CAPPED. IN CASE OF BLOCKING DURING REMOVAL, STOP AND CHECK THAT WIRING OR CONNECTORS ARE NOT TRAPPED OR JAMMED.

D. Remove Waveguide S29

R

R (1) On removed shelf 29-123, waveguide switch, disconnect connector S29A. Cap connectors.

R (2) Disconnect port 1 of waveguide switch from radar antenna
R waveguide.

R NOTE: Pressure window is fitted.

R (3) Disconnect port 3 of waveguide switch from transceiver 1S23.

R (4) Disconnect port 2 of waveguide switch from transceiver 2S23.

R (5) Waveguide switch should now be removable. Retain seals for
R new waveguide switch.

R (6) On removal of waveguide switch, remove plate from port 4 for
R fitment to new waveguide switch.

E. Preparation of replacement component

(1) Remove blanking caps from waveguide switch base and component connector.

(2) Visually check that waveguide switch has no sign of damage or paint scratches, that connector pins are undamaged and have no trace of corrosion.

R (3) Check seals for correct condition. Replace if necessary.

F. Installation of waveguide switch

R
R (1) Install an O-ring seal in each port of waveguide switch.

R (2) On waveguide switch unit, at port 4, position plate and
R secure with four screws and four washers.

(3) Position waveguide switch as follows:

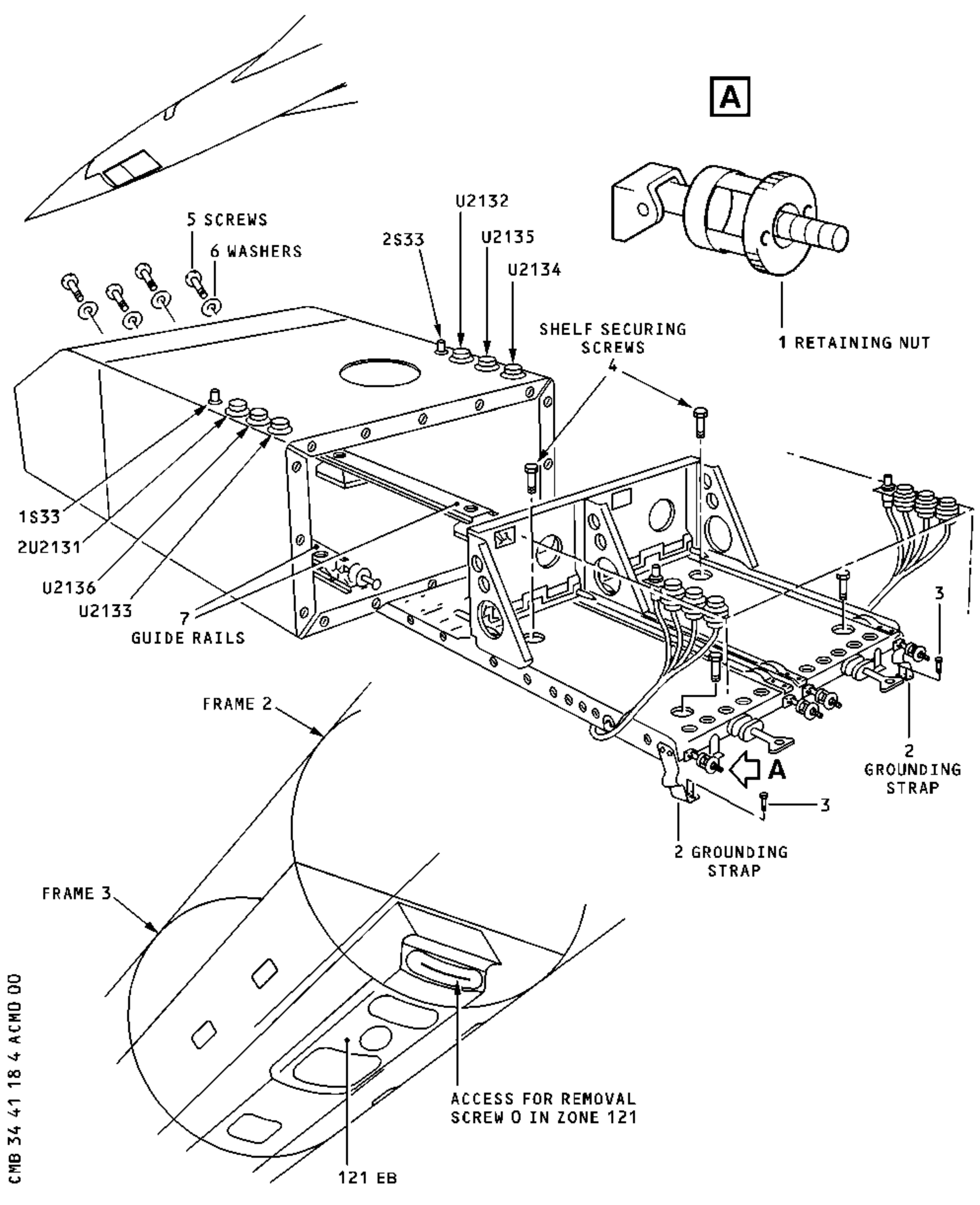
R (a) Port 3 of waveguide switch towards transceiver 1S23.

R (b) Port 1 of waveguide switch towards radar antenna. Fit
R between waveguide switch and flexible waveguide section
R a thin plastic pressure window with a very thin bead of
R DC3145RTVCLEAR sealant on the flexible waveguide flange
R to prevent pressure leakage.

R (c) Port 2 of waveguide switch towards radar transceiver 2S23.

R
R (4) Install the four securing screws and washers on ports 1, 2 and 3.

R
R (5) Remove blanking cap from connector S29A and connect to waveguide switch.



Removal of Shelf 29-123
Figure 402

G. Installation of Shelf 29-123 (Ref. Fig.402)

NOTE: Before installation of shelf, ensure waveguide silicone rubber seal is in a serviceable condition. Replace as necessary.

(1) In forward compartment 123, engage and install the shelf on guide rails (7).

(2) Install without tightening the four screws (4).

(3) In forward compartment 121 at frame 8, gain access through opening in flexible partition, install four wave guide securing screws (5) with washers. Tighten screws (5).

(4) In forward compartment 123 on shelf 29-123, position and tighten retaining nuts (1) on lugs.

(5) Tighten the four screws (4).

R (6) Position grounding straps (2), install and tighten screws (3).

(7) Remove blanking caps from wiring and shelf housing connectors.

(8) Connect and lock connectors.

(9) Install and lock transceivers 1S23 and 2S23, (Ref. 34-00-00, Removal/Installation).

WARNING: MAKE CERTAIN THE WORKING AREA IS CLEAN AND CLEAR OF TOOLS AND MISCELLANEOUS ITEMS OF EQUIPMENT.

R H. Tests

(1) Carry out a functional test (Ref. 34-41-00, Adjustment/Test).

R J. Close-Up

(1) In zone 121, at frame 8, close flexible partition giving access to zone 123.

(2) Close access door 121 EB.

(3) In forward compartment 123, close access door 123 AZ.

(4) Close access door 123 AB.

(5) Remove access platform.

WEATHER RADAR INDICATOR - REMOVAL/INSTALLATION

1. General

Two weather radar indicators are installed in the aircraft, one on the LH side console 1-211, the other on the RH side console 1-212.

WARNING: NEVER PLACE INDICATOR IN FACE DOWN POSITION. THE INDICATOR MUST BE CARRIED BY HANDLE, FACE UPWARDS OR HORIZONTAL.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Blanking caps for electrical connectors	-
Protective cover for radar indicator	-

B. Prepare

(1) On Captain or First Officer radar indicator, make certain
R that STBY is selected.

(2) On centre console 9-211, radar control unit, make certain
R that OFF is selected.

(3) Trip, safety and tag the following circuit breakers:

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	NO 1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
	NO 1 WEATHER RADAR IND		1S 32	C 4
	NO 2 TX RX WEATHER RADAR SUP	13-216	2S 30	E18
	NO 2 WEATHER RADAR IND		2S 32	E19
R	CTR CONSOLE INST LTS SUP	14-216	L 405	B 8

C. Remove (Ref. Fig.401)

(1) Unlock the four dzus fasteners (10) from shroud (1). Remove shroud.

(2) Move lever assembly (6) to release pin (8) on radar indicator (2).

(3) Move handle (9) upwards to limit stop. Using handle, withdraw radar indicator (2) upwards to free it from indicator housing (3).

(4) Place protective cover on face of radar indicator (2) to prevent damage to cathode ray tube.

(5) Fit blanking caps to connectors (5) and (7).

D. Preparation of Replacement Component

(1) Make certain that indicator housing (3) is clean, guide rails (4) are in correct condition and that aircraft system plug connector (5) is undamaged.

(2) Make certain that radar indicator (2) is in correct external condition, that rear connector (7) is undamaged and free from corrosion. Visually check appearance of cathode ray tube and correct operation of filter.

E. Install (Ref. Fig.401)

(1) Remove blanking caps from connectors (5) and (7).

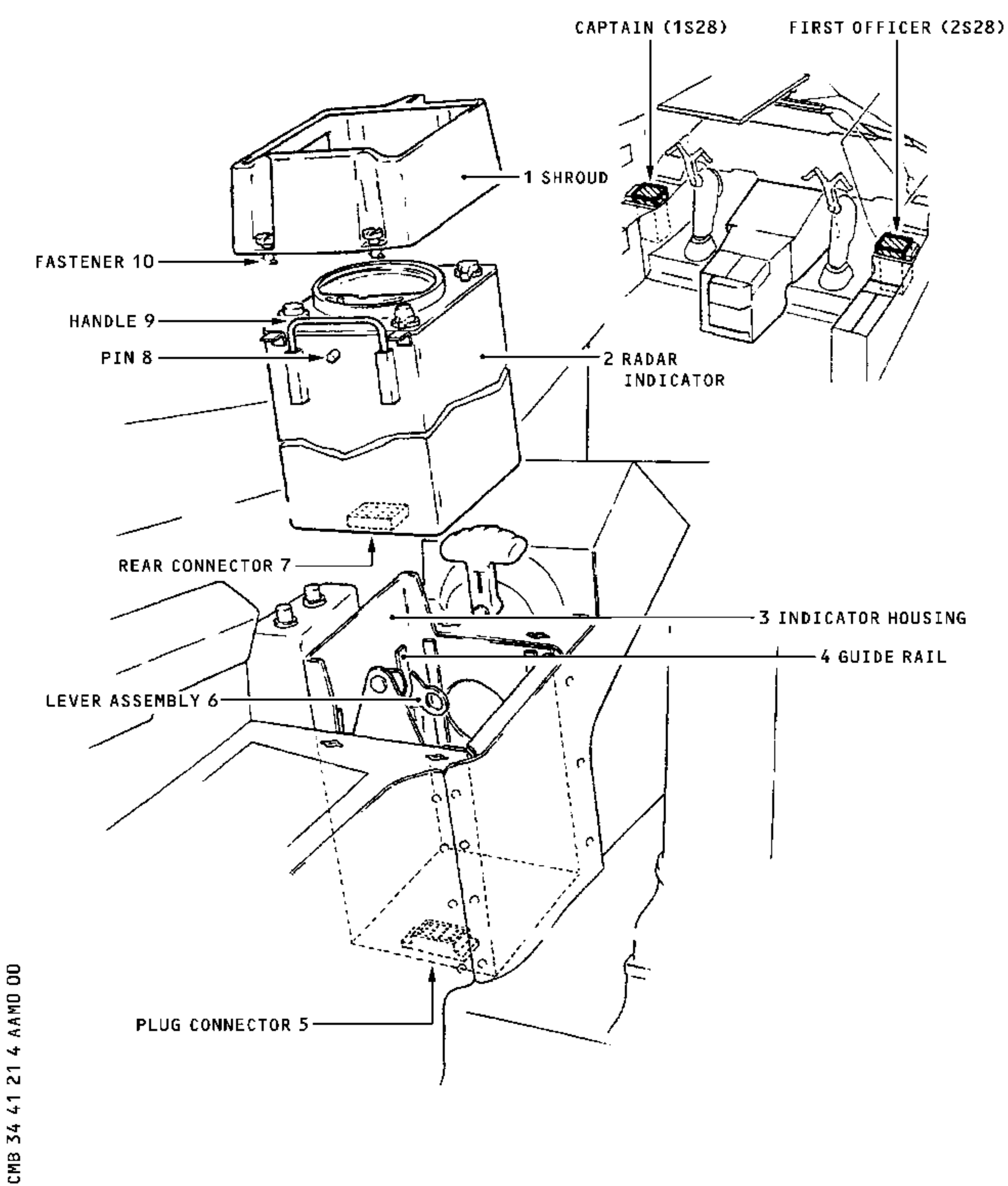
(2) Remove protective cover from face of radar indicator (2).

(3) Holding handle (9) gently slide radar indicator (2) along guide rails (4) of indicator housing (3).

(4) Lower handle (9) to limit stop.

(5) Engage lever assembly (6) with pin (8) to lock indicator (2) in indicator housing (3).

(6) Position shroud (1) and lock the four dzus fasteners (10).



Removal/Installation of Radar Indicator
Figure 401

F. Tests (Ref. Fig.402)

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2.B.(3).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00, Servicing).

(4) On panel 4-211, place CENTRE CONSOLE PANEL selector switch
R in mid position, indicator lighting comes on. Put into
R operation INS1 and INS2 systems (Ref. 34-45-00,
R Adjustment/Test).

R (5) On replacement indicator select a range.

(6) On centre console 9-211, radar control unit:

(a) Place system transfer switch in position required for system to be checked.

R (b) Select TEST on radar control panel.

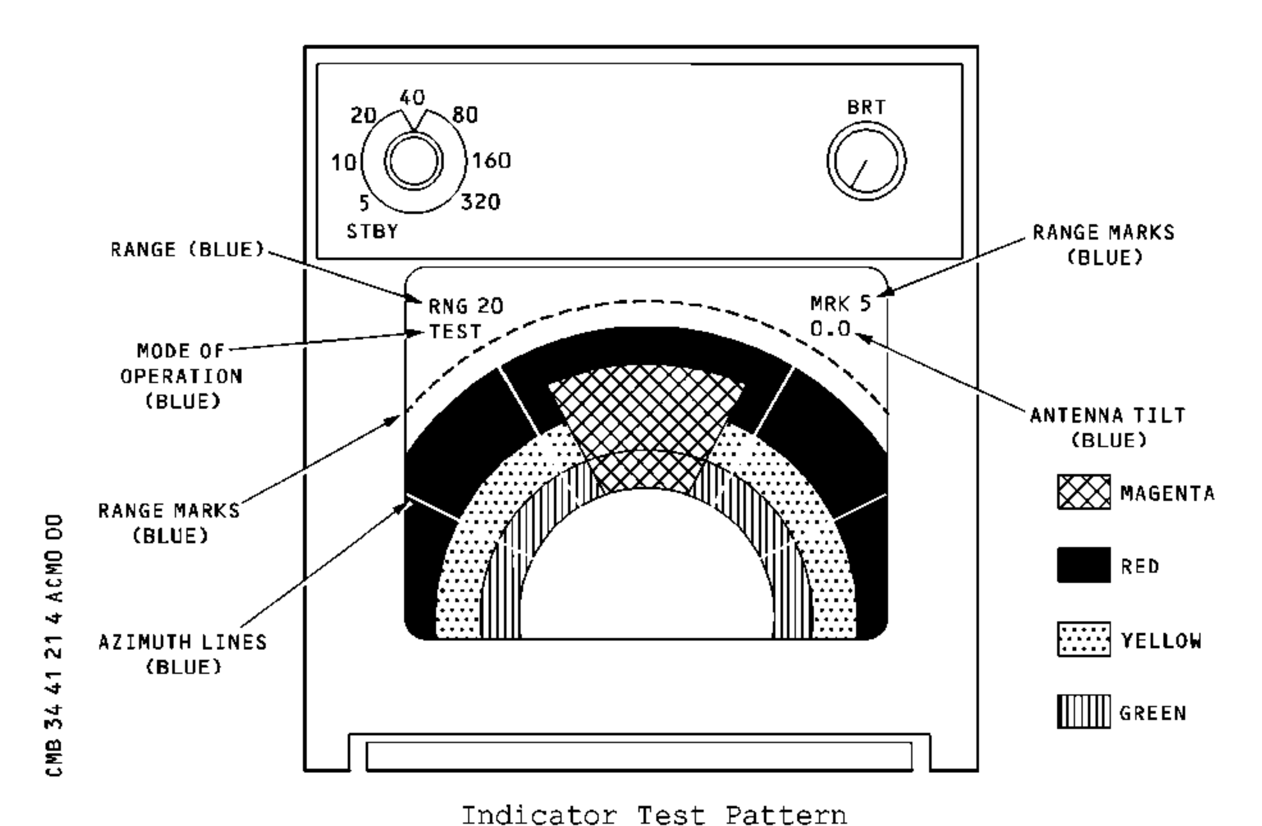
(7) On indicator in operation:

R (a) Adjust brightness by turning BRT potentiometer in clockwise direction.

R (b) Place range selection switch to any selection except STBY.

R (c) Cause 5, 10, 20, 40, 80, 160 and 320 Nm range marks to
R appear on indicator by turning range selection switch.

R (d) After a short time delay check that indicator display
R is similar to that shown on Fig.402, Indicator Test
R Pattern.



R Indicator Test Pattern
Figure 402

G. Close-Up

R (1) On centre console 9-211, radar control unit, select OFF.
R Range marks disappear.

(2) On indicator in operation:

R (a) Turn range selection switch counter-clockwise to STBY
R position.

R (b) Turn BRT control to low intensity.
R

(3) On panel 4-211, place CENTRE CONSOLE PANEL selector switch in OFF position.

R (4) Switch off INS1 and INS2 systems (Ref. 34-45-00,
R Adjustment/Test).

R (5) Switch off electronics rack ventilation system (Ref. 21-21-00, Servicing).

R (6) Denergize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

INDICATOR UNIT/RADAR ALERT - REMOVAL/INSTALLATION

1. General

WX RDR warning lamps, on indicator units (1F277) on panel 2-211/4 and (2F227) on panel 2-212/3 were connected to the target alert module located in the AVQ-30X weather radar transceiver which provided a radar alert signal when a large echo was detected in front of the aircraft.

This is no longer a facility on modern digital radars and the AVQ-30X target alert facility was deleted by modification EOC-CON-034G286 which installed a digital RDR-4B type radar. As a consequence, the target alert lamps are no longer connected to the weather radar but as the indicator units are still used for other functions, the target alert lamps now only work for lamp test. The RADAR ALERT switch (S34) which activated the target alert facility is also deleted with the installation of the RDR-4B radar.

This removal/installation topic concerns indicator units (1F277) and (2F277).

2. Indicator Unit

The indicator unit comprises:

- at the front, a lampholder assembly comprising four caption screens marked R NAV, TK Q/S, VOR FQY and WX RDR, behind which are mounted eight filament lamps (2 lamps per caption),
- at the centre, a base/block assembly enclosing four filament lamp control and dimming circuits, and
- at the rear, a receptacle assembly for connections to the aircraft electrical network.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Blanking caps	-

B. Prepare

(1) On panel 5-512, ensure that SW D/B LIGHT switch is in HI position.

(2) On panel 12-211, ensure that SW D/B light switch is in HI position.

R
R (3) Trip, safety and tag the following circuit breakers,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
PLT'S LT TEST SUP	15-215	L1001	E14
CARD READER 1 SUP		1F 222	D 5
CARD READER 2 SUP	15-216	2F 222	E20

C. Remove (Ref. Fig.401)

(1) Mounting plate assembly on Captain instrument panel

(a) Remove the three screws (4) attaching mounting plate assembly (9) to instrument panel (8).

(b) Withdraw mounting plate assembly (9) from seating (7) in instrument panel (8).

(c) Disconnect aircraft connector (6) from rear connector (5) on mounting plate assembly (9).

(d) Cap connectors (5) and (6).

(2) Mounting plate assembly on First Officer instrument panel

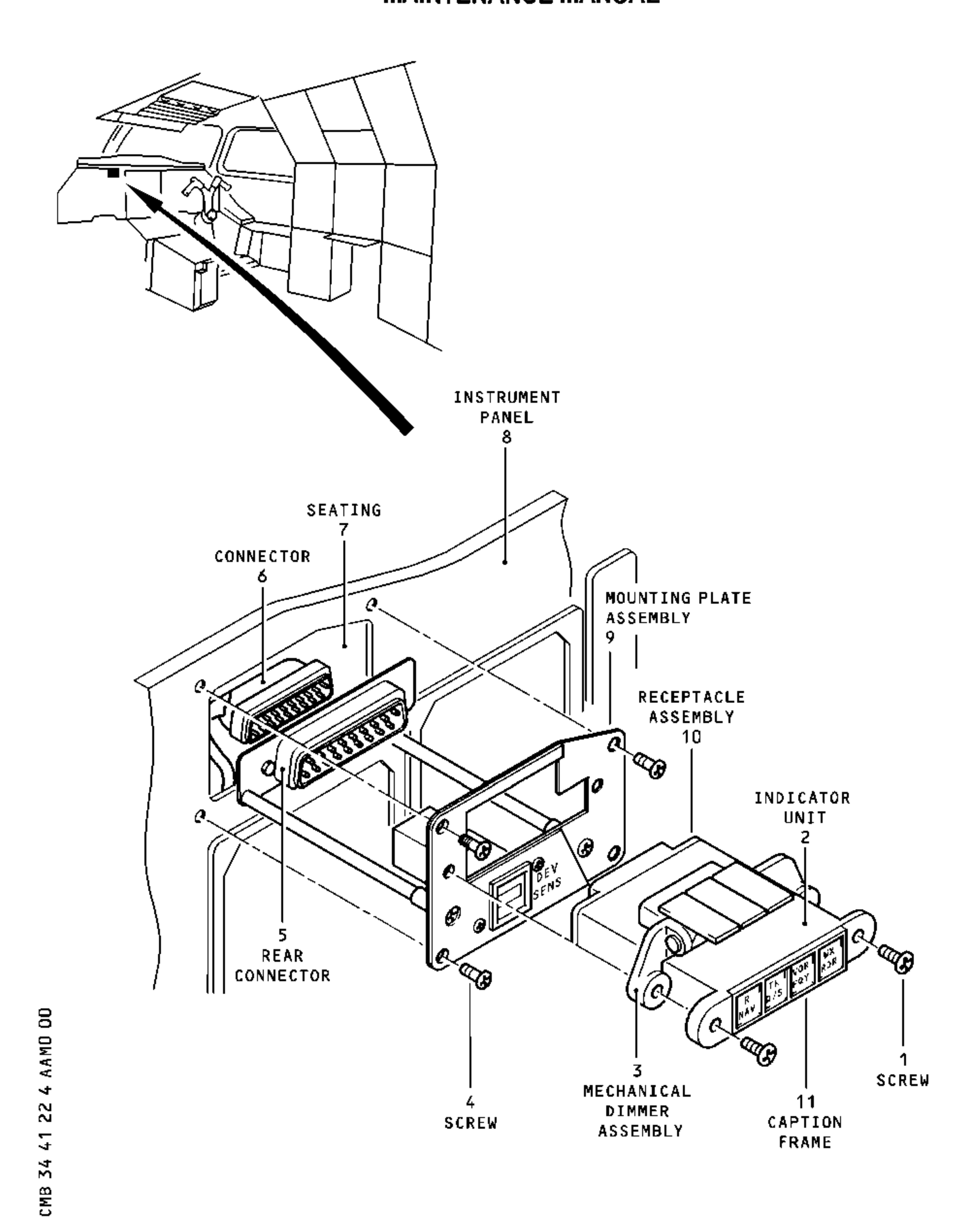
(a) Remove the four screws (4) attaching mounting plate assembly (9) to instrument panel (8).

R (b) Repeat operations 2.C.(1)(b) to 2.C.(1)(d) inclusive.

(3) Indicator unit

(a) Disconnect wires from indicator unit (2) receptacle assembly (10).

(b) Remove two screws (1) attaching indicator unit (2) and mechanical dimmer assembly (3) to mounting plate assembly (9).



Indicator Unit - Removal/Installation
Figure 401

(c) Withdraw indicator unit (2) from mounting plate assembly (9).

(d) Remove mechanical dimmer assembly (3).

D. Preparation of Replacement Component

(1) Ensure that indicator unit is in correct condition and that there are no traces of corrosion on receptacle assembly.

(2) If necessary, remove caption frame (11) and replace the four caption screens.

E. Install (Ref. Fig.401)

(1) Indicator unit

(a) Position mechanical dimmer assembly (3) on mounting plate assembly (9).

(b) Engage indicator unit (2) in mounting plate assembly (9).

(c) Position and install the two screws (1) attaching indicator unit (2) and mechanical dimmer assembly (3) to mounting plate assembly (9).

(d) Connect wires to indicator unit (2) receptacle assembly (10).

(2) Mounting plate assembly on First Officer instrument panel

(a) Remove blanking caps from connectors (5) and (6).

(b) Connect aircraft connector (6) to mounting plate assembly (9) rear connector (5).

(c) Position mounting plate assembly (9) in seating (7) in instrument panel (8).

(d) Position and install the four screws (4) attaching mounting plate assembly (9) to instrument panel (8).

(3) Mounting plate assembly on Captain instrument panel

(a) Repeat operations 2.E.(2)(a) to 2.E.(2)(c) inclusive.

(b) Position and install the three screws (4) attaching mounting plate assembly (9) to instrument panel (8).

F. Close-Up

(1) Remove safety clips and tags and reset the circuit breakers
R tripped in para.2.B.(3).

(2) Carry out test of indicator unit (Ref. Adjustment/Test).

3. Indicator Unit Relamping

Relamping of one or more indicator unit lamps must only be done after removal/installation of indicator unit (Ref. para.2).

A. Equipment and Materials

DESCRIPTION	PART NO.
Filament lamp 28 V, 0.02 A	-

B. Prepare

(1) Refer to para.2.B.

C. Remove mounting plate assembly and indicator unit

(1) Refer to para.2.C.

D. Relamping

(1) With a straight pull, release lampholder assembly from base/block assembly detent position.

(2) Pivot lampholder assembly through 90° upwards.

(3) Remove lamp(s) to be replaced from their seating.

(4) Install new lamp(s) in their seating.

(5) Pivot lampholder assembly through 90° downwards.

(6) With a straight push, lock lampholder assembly in base/block assembly detent position.

E. Install indicator unit and mounting plate assembly

(1) Refer to para.2.E.

F. Close-Up

(1) Refer to para.2.F.

R
R

PRINTED IN ENGLAND

R INDICATOR UNIT/RADAR ALERT - ADJUSTMENT/TEST

1. General

R The AVQ-30X target alert facility was deleted by modification
R EOC-CON-034G286 which installed a digital RDR-4B type radar. As a
R consequence, the Target Alert lamps are no longer connected to the
R weather radar but as the indicator units are still used for other
R functions, the Target Alert lamps now only work for lamp test.
This test must be carried out after replacement of the indicator unit or after relamping.

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical ground power unit	-

B. Prepare

(1) On panels 12-211 and 5-212, ensure that SW D/B LIGHT switches are in HI position.

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00, Servicing).

(4) Lift dimmer flaps on R NAV indicator lights on panels 2-211/4 and 2-212/3.

C. Tests

(1) Indicator unit on Captain instrument panel.

(a) On LH side console 12-211, place and hold SW D/B LIGHT switch in TEST position:

- on panel 2-211/4, R NAV, TK Q/S, VOR FQY and WX RDR lights illuminate.

(b) Release SW D/B LIGHT switch and ensure that it returns to HI position:

- on panel 2-211/4, R NAV, TK Q/S, VOR FQY and WX RDR lights extinguish.

(2) Indicator unit on First Officer instrument panel.

(a) On RH side console 5-212, place and hold SW D/B LIGHT switch in TEST position:

- on panel 2-212/3, R NAV, TK Q/S, VOR FQY and WX RDR lights illuminate.

(b) Release SW D/B LIGHT switch and ensure that it returns to HI position:

- on panel 2-212/3, R NAV, TK Q/S, VOR FQY and WX RDR lights extinguish.

D. Close-Up

(1) Lower dimmer flaps on R NAV indicator lights on panels 2-211/4 and 2-212/3.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00, Servicing).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

WEATHER RADAR TRANSCEIVER - REMOVAL/INSTALLATION

1. General

Two weather radar transceivers (1S23 and 2S23) are located side by side in FWD underfloor compartment, in zone 123 on shelf 29-123 mounts.

2. Weather Radar Transceiver

NOTE: As both transceivers are identically installed, only one removal/installation procedure is described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Blanking plugs/caps for electrical connectors	-
Waveguide blanking caps	-
Blanking plates for ventilation outlets	-
Access platform, height 11 ft 4 in (3.5 m)	-

B. Prepare

(1) On centre console 9-211, on weather radar control panel, make certain that OFF is selected.

(2) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NO 1 TX RX WEATHER RADAR SUP	13-215	1S 30	B 4
NO 1 WEATHER RADAR IND		1S 32	C 4
NO 2 TX RX WEATHER RADAR SUP	13-216	2S 30	E18
NO 2 WEATHER RADAR IND		2S 32	E19

(3) Position access platform.

(4) Open door 123 AB to gain access to weather radar equipment bay.

(5) Remove shelf 29-123 protective plate.

C. Remove

R NOTE: Handle transceiver with care.

(1) Refer to 34-00-00, Removal/Installation, para. 2.D.(1).

R

R (2) Fit blanking cap to waveguide fitting on rear panel of removed component.

D. Preparation of Replacement Component

R (1) Refer to 34-00-00, Removal/Installation, para. 2.E.

R

(2) Remove blanking cap from waveguide fitting ensuring that there is no trace of oxidation or scratches.

E. Install

(1) Refer to 34-00-00, Removal/Installation, para. 2.F.(1).

F. Close-Up

(1) Remove safety clips and tags and reset the circuit breakers tripped in para. 2.B.(2).

(2) Carry out operational test of the relevant weather radar system (Ref. 34-41-00, Adjustment/Test).

(3) Install shelf 29-123 protective plate.

(4) Close weather radar equipment bay door 123 AB.

(5) Remove access platform.

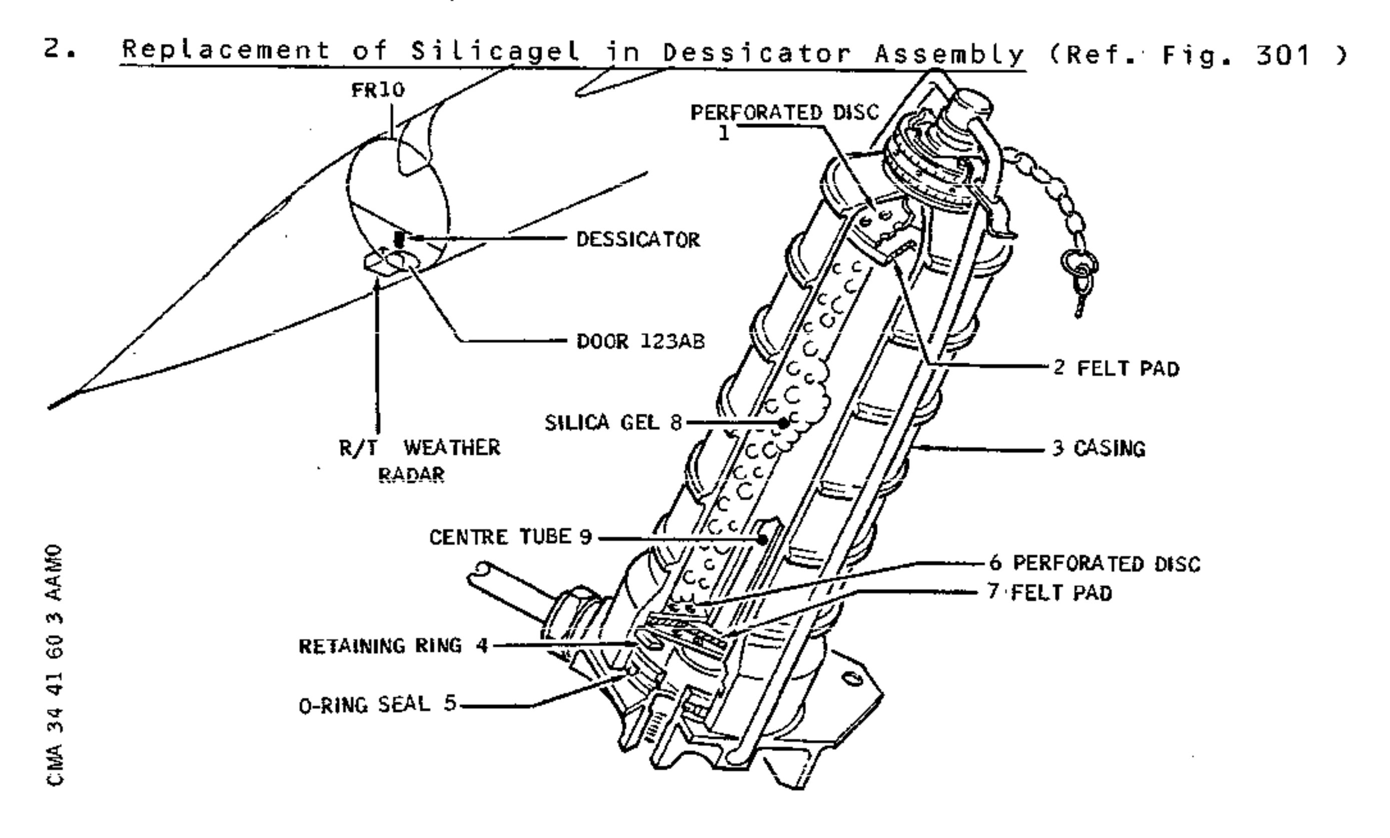
DESSICATOR ASSEMBLY - SERVICING

1. General

The dessicator assembly used in the wave guide pressurization system is a transparent cartridge containing silicagel crystals. This cartridge is installed on a seat located in zone 123 (weather radar compartment).

The dessicator crystals must be colored blue.

2. Replacement of Silicagel in Dessicator Assembly (Ref. Fig. 301)



Dessicator Assembly : Interior View of Cartridge
Figure 301

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform, 3.5 m (11.5 ft)	

DESCRIPTION	PART NO.
Silicagel	

B. Prepare

(1) In zone 123, position access platform and open door 123AB.

(2) Remove dessicator cartridge, ref. 34-41-60, para. 2. C. (R/I).

C. Replacement of Silicagel in Cartridge

(1) Remove retaining ring (4), perforated disc (6) and felt pad (7) from center tube (9) in cartridge casing (3).

(2) Empty crystals (8) from cartridge by extracting center tube (9) with its fixed perforated disc.

(3) Visually inspect assembly :

(a) Make certain that cartridge casing (3) is clean and undamaged. Clean inside of casing (3), center tube (9) and perforated discs (1 and 6) with a clean lint-free cloth. Make certain that these parts are clean and dry.

(b) Check that seat openings are clean and that O-ring seal (5) is usable, replace if necessary.

(4) Position center tube (9) with fixed perforated disc (1) and felt pad (2).

(5) Fill with dry silicagel crystals (8) gently tapping bottom of casing (3) in order to completely fill. Allow approximately 5 mm (0.19 in.) space below retaining ring housing in order to be able to complete cartridge assembly.

(6) Position felt pad (7) and perforated disc (6) in casing (3) and complete assembly by inserting retaining ring (4) in its housing.

D. Close-Up

(1) Install dessicator cartridge, ref. 34-41-60, para.

2. E., (R/I).

(2) Close door 123AB and remove access platform.

DESSICATOR ASSEMBLY - REMOVAL/INSTALLATION

1. General

The dessicator assembly is located in the weather radar transceiver compartment in zone 123 and can be removed :

- for exchange or refilling following check carried out in
R 34-41-60, Servicing and Inspection/Check
R - for a wave guide sealing test (Ref. 34-41-00, Adjustment/Test)

2. Dessicator Cartridge (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform, 3.5 m (11.5 ft)	

B. Prepare

(1) In zone 123, position access platform and open door 123AB.

C. Remove

(1) Remove locking pin (14) from locknut (12) on cartridge (1).

(2) Lift and hold lockplate (11) to free ratchet (13) from locknut (12).

(3) Using locking pin (14) inserted in holes in locknut (12).
Loosen locknut until stirrup (10) is released.

(4) Pull stirrup (10) forwards.

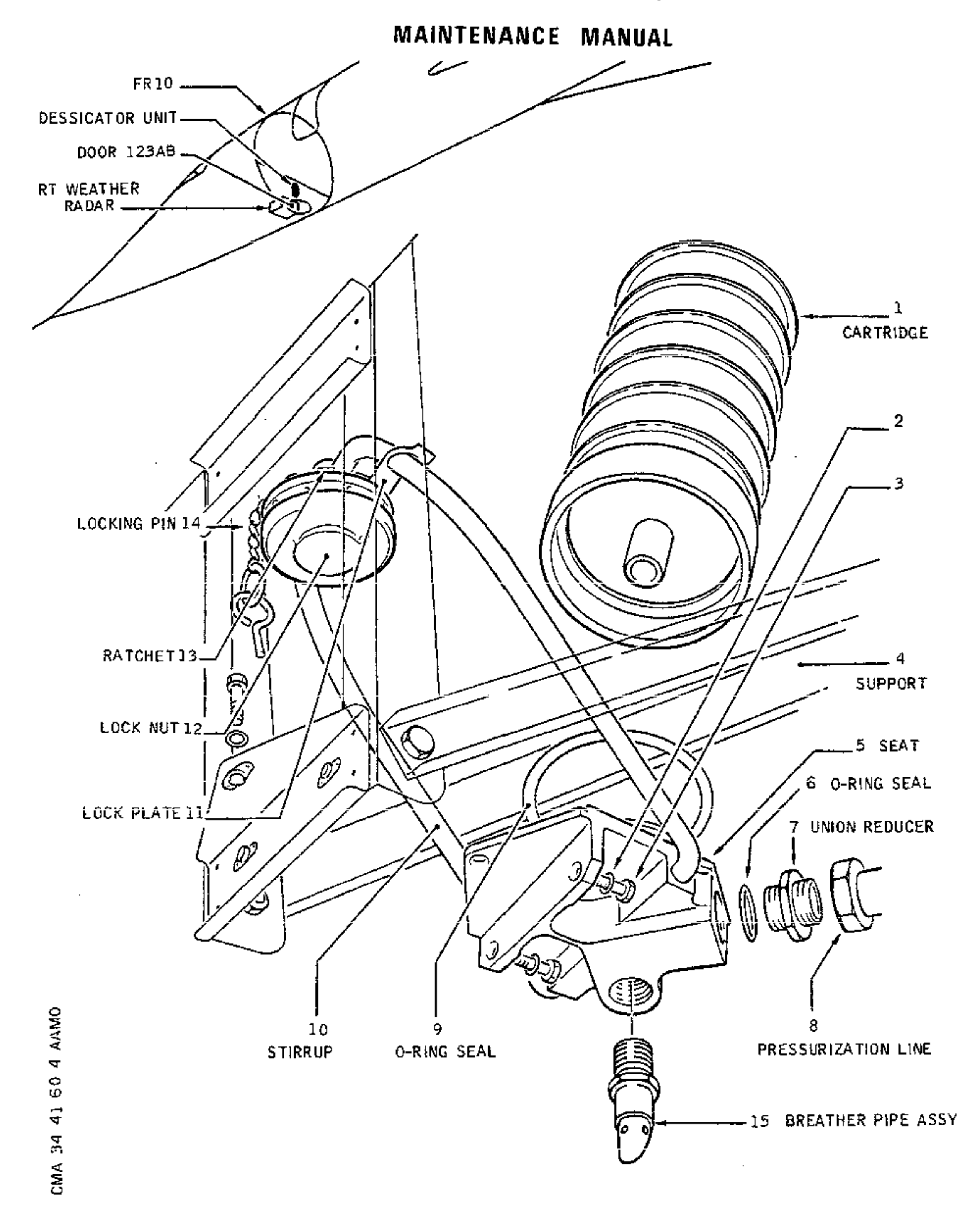
(5) Remove cartridge (1) from seat (5).

D. Preparation of Replacement Component

(1) If a new cartridge is to be installed :

(a) Remove protective covering from open end of cartridge.

(b) Check that cartridge is clean, undamaged and



R

Dessicator Assembly : Removal/Installation
Figure 401

that disc and center tube holes are not obstructed and silicagel crystals are colored blue.

(2) If the silicagel only is to be replaced, refer to 34-41-60, S.

E. Install

(1) Check that :

(a) O-ring seal (9) on seat (5) is in good condition, replace if necessary.

(b) Ports in seat (5) are not blocked.

(2) Place open end of cartridge (1) in seat (5) and check that O-ring seal (9) is properly seated.

(3) Reposition stirrup (10) on cartridge (1).

(4) Manually tighten locknut (12) until cartridge (1) is securely fixed on seat (5).

(5) Place locking pin (14) in hole in locknut (12) making certain locknut is locked and check that lockplate is slotted into ratchet (13) on locknut (12).

F. Close-Up

(1) Close door 123AB and remove access platform.

3. <u>Seat</u>
R (Ref. Fig. 401)

<u>NOTE</u> : This operation is only carried out as necessary.

A. Equipment and Materials

Refer to removal/installation of dessicator cartridge (para. 2. A.).

B. Prepare

Refer to removal/installation of dessicator cartridge (para. 2. B.).

C. Remove

(1) Remove dessicator cartridge (Ref. para. 2. C.).

(2) Remove nut from wave guide pressurization line (8).

(3) Disconnect pressurization line (8) from union reducer (7) on seat (5). (In case of seat (5) replacement, remove union reducer (7)).

R (4) Loosen and remove breather pipe assembly (15).

R (5) Loosen and remove three mounting screws (2) and their washers (3), while supporting seat (5).

R (6) Remove seat (5) from support (4).

R (7) Blank off aircraft pressurization line (8).

D. Preparation of Replacement Component

(1) If a new seat is to be installed :

(a) Remove blanking caps from ports.

(b) Check that screw threads are undamaged and that openings are not obstructed.

(c) Install union reducer (7) fitted with O-ring seal (6) in output port.

R (d) Position and tighten breather pipe assembly (15).

E. Install

(1) Remove blanking cap from aircraft pressurization line (8).

(2) Position seat (5) on support (4) and install three screws (2) with washers (3).

(3) Tighten three screws (2) to normal tightness.

(4) Fit aircraft pressurization line (8) on union reducer (7) and tighten nut on aircraft line.

(5) Install dessicator cartridge, (Ref. para. 2. E.).

F. Close-Up

(1) Close door 123AB and remove access platform.

DESSICATOR ASSEMBLY - INSPECTION/CHECK

1. General

The dessicator used in the waveguide pressurization system consists of a cartridge containing silicagel crystals. The condition of the crystals can be checked visually in the transparent cartridge, which is located in zone 123, weather radar transceiver compartment, and which is accessible by means of door 123AB.

2. Inspection - Check

A. Dessicator Assembly

(1) Check that the sigicagel crystals in the dessicator cartridge are colored blue, indicating that they are not saturated with water.

(2) Check that the components and aircraft pressurization ducting are clean, undamaged and without traces of corrosion.

(3) Check that orifices are not obstructed.

1. General

The radio altimeter system provides altitude data to be used
R by the All-Weather Automatic Landing System (AWALS) and also used during low-altitude flight (LAF).
It provides the crew with accurate data concerning the height of the aircraft with respect to the ground above which it is flying, independently of atmospheric pressure.
It is provided with an automatic calibration loop which ensures its accuracy (between 0 and 100 feet ± 1 foot and between 100 and 2500 ft ± 4 %) and with an altimeter channel monitoring system.

2. System Components

The radio altimeter system consists of :

R A. Components Specific to System

- Two transceivers (1S51 and 2S51)
- Two altitude indicators (1S53 and 2S53)
- R Two transmission antennas (1S54 and 2S54)
- R Two reception antennas (1S55 and 2S55)

R B. Components Common to Other Systems

- Two dimming modules (L1071C and L1072C)
- R Two attitude director indicators (ADI) (1F23 and 2F23)
- Two azimuth AP/FD computers (1C13 and 2C13)

3. Transceiver - TRT AHV5

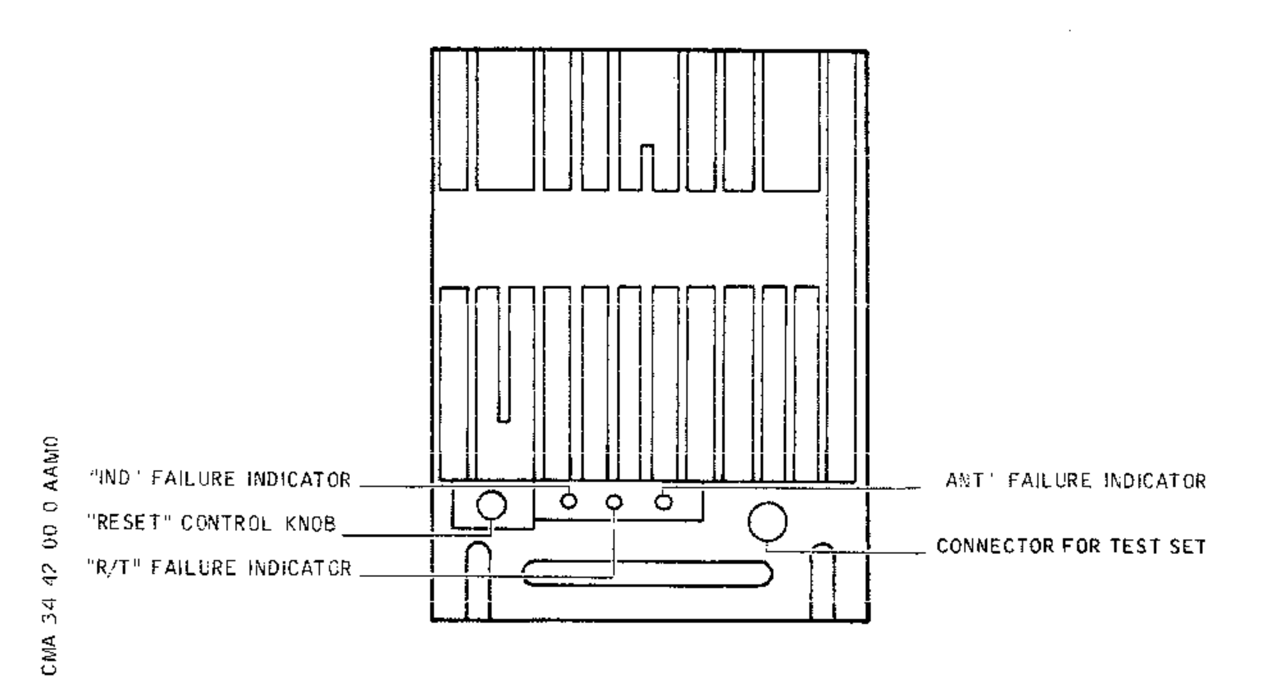
A. Description (Ref. Fig. 001)

(1) Mechanical characteristics

R The unit is contained in a 1/2 ATR short case and
R weighs 7.5 kg (16.5 lb.).

R (a) On the front panel there are :

- R One test connector
- Two mounting lugs used to lock the unit in position
- One handling grip
- R Three magnetically latched failure indicators
R marked IND, T/T and ANT.
- One RESET control knob used to clear failure



R Transceiver - Front View
Figure 001

indications.

R NOTE : This panel has vertical fins to provide a good cooling surface for the UHF source.

R (b) On the rear panel there are two co-axial connec-
R tors for connection of transmission-reception an-
R tenna cables and one electrical connector for external connections.

(2) Electrical characteristics

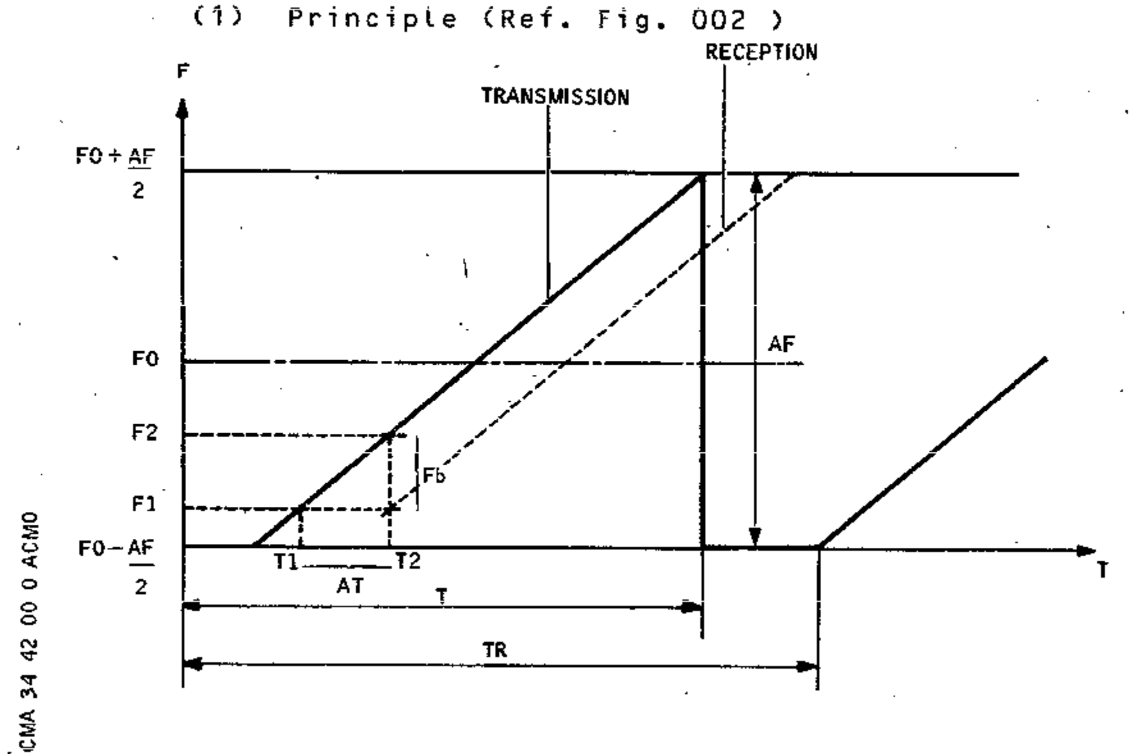
The transceiver uses frequency modulation and operates in the 4200 - 4400 MHz band with a frequency deviation
R of approximately 123 MHz. Its pulse repetition fre-
R quency is linked to the altitude and ranges between
R approximately 20 and 400 Hz.
The radiated power is minimum 250 mW.
R It is supplied with 115 VAC - 400 Hz and its maximum
R power consumption is 100 VA. The cut-out or re-initiation altitude is greater than 5000ft.

The operation of the self-calibration and self monitoring devices is effective after a delay of less than 10 seconds.

B. Operation



R (1) Principle (Ref. Fig. 002)



Transceiver - Modulation Principle
Figure 002

The principle of operation is based on that of conventional frequency-modulated radio altimeters, which use the differential beat between the signal radiated by the transmitter and the ground reflected signal.

The transmitter radiates a frequency-modulated wave towards the ground. At time T1, the frequency of this wave is F1.

R After a time AT, the wave radiated at frequency F1 is reflected by the ground and received by the receiver.
During this time, the transmitter frequency has shif-

ted from F1 to F2.

At time T2 (T1 + AT), the F1 signal received by the receiver is compared in a mixer with a fraction of the
R F2 transmission signal. This results in a beat signal Fb, the frequency of which equals F2 - F1.

The beat signal Fb is then amplified and smoothed in a low-frequency amplifier channel. As the frequency deviation is fixed, a servo loop makes it possible to keep the beat frequency Fb constant. If the frequency shift "AF" and the beat frequency Fb are kept constant then there exists a linear relation between the duration of T (the modulation sawtooth period) and altitude.

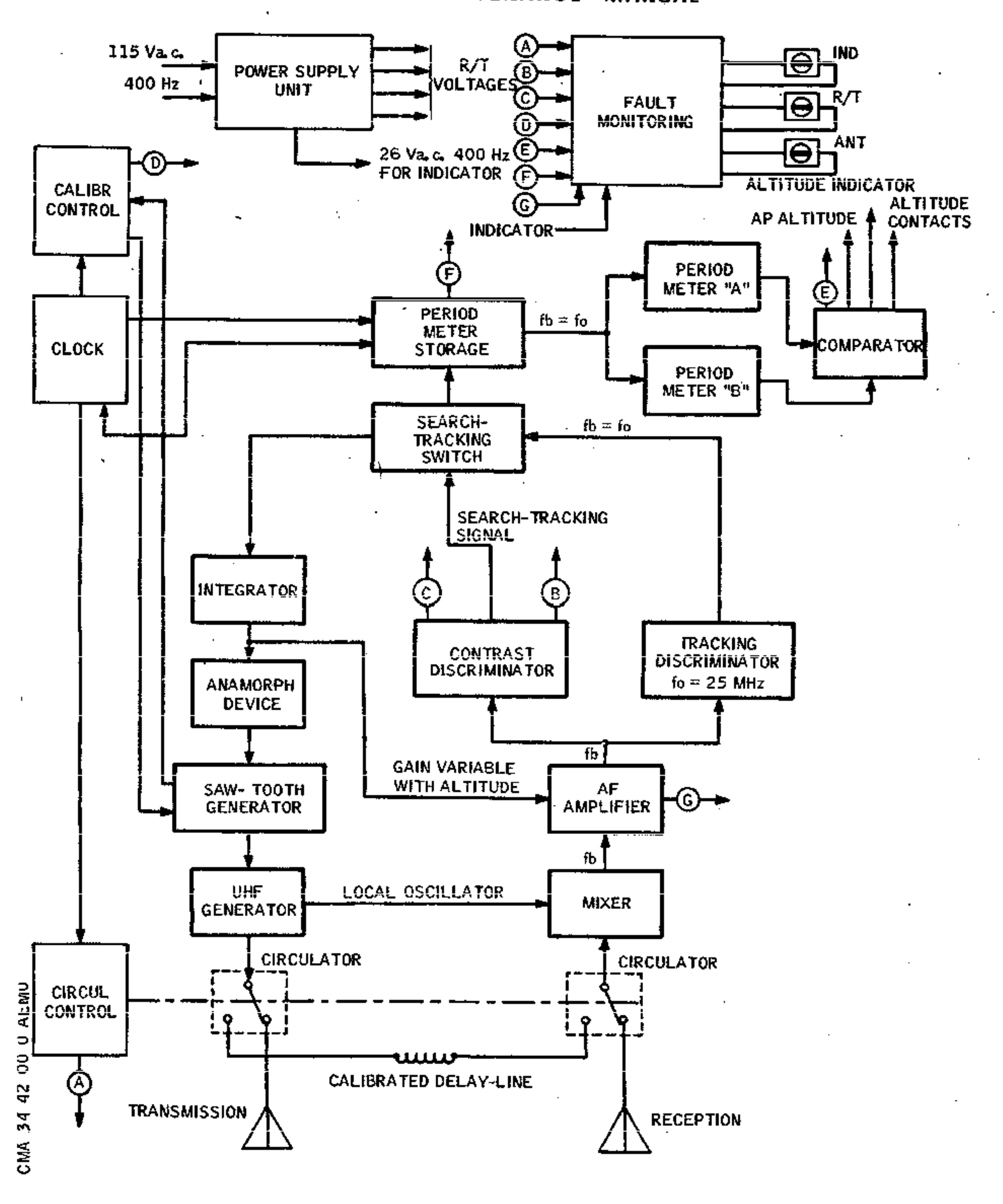
The altitude indication is therefore obtained by measurement of the modulation period T.

(2) General Operation (Ref. Fig. 003)

A sawtooth generator controlled by an anamorphoser (dynamic gain corrector) output voltage, supplies a wobbulation voltage to a UHF source.

This UHF source emits frequency modulated signals in the 4200 to 4400 MHz band. The signals are transmitted to the output circuit (circulator- transmission antenna).
The signal reflected by the ground is applied by the input circuit (circulator-reception antenna) to a UHF
R mixer, which also receives a fraction of the transmission signal.
At the mixer output, the resultant signal Fb is applied to a low-frequency amplifier whose gain varies with altitude.
The amplified Fb signal is then applied to the tracking discriminator which detects the difference between the Fb signal and the discriminator reference signal Fo.
The tracking discriminator allows altitude measurement when Fb = Fo.

- If the Fb signal is at the proper level, the system is in normal operation (track phase), and the tracking discriminator output is applied to the two periodmeters, which make the "sawtooth duration/DC voltage" conversion, supply altitude indication to the indicator and the auto-pilot.
- If the Fb signal is not absolutely equal to the Fo signal, the tracking discriminator applies an



Transceiver - Operation Block Diagram
Figure 003

error signal to an integrator, which continuously applies a signal whose gain is variable with altitude to the low frequency amplifier, which adjusts the Fb signal to the Fo value, and to the anamorphoser, which maintains servo loop constant regardless of altitude.

The contrast discriminator receives the amplified Fb signal, and monitors its level and quality. If it detects an anomaly in the Fb signal, it then actuates a "search-tracking" switch, which takes up the "search" position, and :

- Initiates a programmed search, starting with the lowest altitudes
- Stores the last recorded altitude
- Delivers a warning if no signal is detected during a complete search period
- Stops the search phase as soon as a beat signal Fb at the proper level is obtained, allowing altitude measurement (track phase) and cancellation of the warning.

To allow checking of the radio altimeter, a reference delay line measurement is substituted periodically for the "external" altitude measurement. This delay line is switched to the "transmission-reception" circulators by a clock. The check is called "internal" measurement.
During internal measurement, the periodmeters are stored, and a self-calibration signal applied to the sawrooth amplitude in order to correct any slow drifts which might occur.
The self-calibration, periodmeter storage and clock signals are synchronized with the sawtooth generator frequency.
A fault monitoring system make it possible, by means of magnetic latch indicators on the front panel of the transceiver, to determine which component of the system is defective (R/T, IND or ANT).

CONFIGURATION	FAILURE INDICATOR-"R/T"	FAILURE INDICATOR-"IND"	FAILURE INDICATOR-"ANT"
NORMAL OPERATION (-20 to 2500 ft)	CLEARED	CLEARED	CLEARED
BETWEEN 2500 ft	CLEARED	CLEARED	CLEARED

CONFIGURATION	FAILURE INDICATOR-"R/T"	FAILURE INDICATOR-"IND"	FAILURE INDICATOR-"ANT"
and CUT-OUT			
ABSENCE OF SIGNAL	CLEARED	CLEARED	CLEARED
TRANSCEIVER FAILURE	VISIBLE	CLEARED	CLEARED
R INDICATOR FAILURE	CLEARED	VISIBLE	CLEARED
CO-AXIAL CABLE/ ANTENNA FAILURE	CLEARED	CLEARED	VISIBLE
MANUAL TEST	CLEARED	CLEARED	CLEARED

NOTE : The 3 failure indicators are latched ; they memorize even a transient failure and remain in the fail configuration.
When the transceiver is defective, the IND and ANT failure indicators are inhibited. The R/T failure indicator and one of either IND or ANT
R failure indicators are simultaneously activated
only in the following cases.

R - The IND or ANT failure indicator indicates a failure before the transceiver fails.
R - The IND or ANT failure indicator indicates a failure after the fault in the transceiver has disappeared.

R Each failure indicator is controlled by selected cir-
R cuits which allow checking of :

- Circulator switching
- Internal contrast
- External contrast
- The self-calibration loop output voltage
- The periodmeter output voltage comparator
- The periodmeter storage
- The low-frequency amplifier
- The indicator

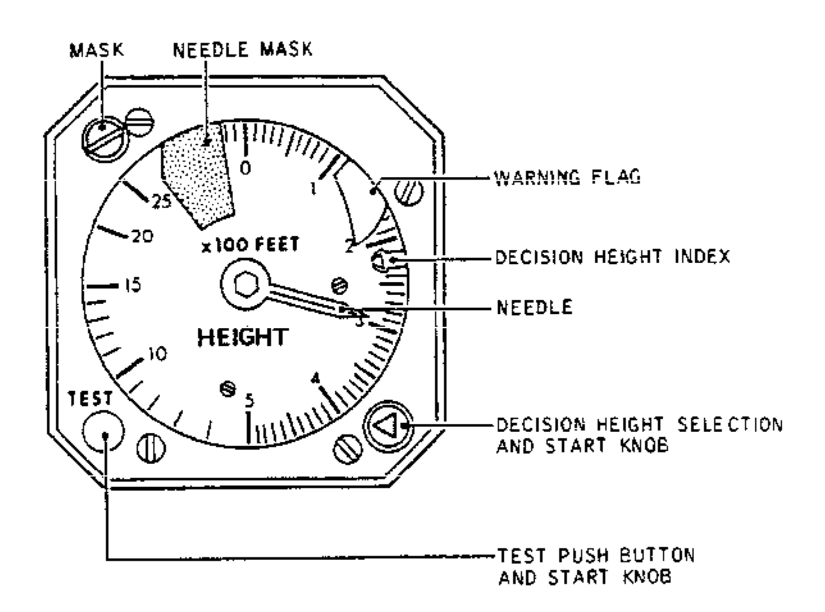
As soon as a failure is detected the monitoring system causes the indicator warning flag to appear, and sends a warning signal to the auto pilot

Six independent preset altitude contacts open or close when the aircraft reaches the preset altitudes. The external 400 Hz - 115 VAC voltage is applied to a power supply unit which distributes all the AC and DC voltages required by the transceiver and the 26 VAC - 400 Hz voltage required by the indicator.

4. Altitude Indicator TRT - IND-521

A. Description (Ref. Fig. 004)

RB



CMA 34 42 00 0 AKMP

RB

Altitude Indicator - Front View
Figure 004

Designed for instrument panel mounting, the indicator with transceiver weighs less than 0.9 kg (1.98 lb.)

(1) On the face are:

(a) A circular scale graduated from -20 to 2500 ft.

(scale multiplication factor : 100) as follows :

- Zero and five graduations are at 12 and 6 o'clock positions respectively.
- The scale is linear from - 20 ft to 500 ft and logarithmic from 500 to 2500 ft.
- The scale is marked in 10 ft increments between -20 and 500 ft, in 100 ft increments between 500 and 1500 ft and in 500 ft increments between 1500 and 2500 ft.
- Scale markings are white on a black ground.

(b) A spearhead pointer with a white tip

(c) A black pointer mask, which merges with the dial, behind which the pointer is hidden above 2500 ft.

(d) A warning flag mask marked OFF covers the flag when the unit is switched off. The mask is controlled by the knob marked with a triangle (between approximately -10 and -15 ft).

(e) A red warning flag which indicates transceiver or indicator faults. In warning position it masks the scale from approximately 110 ft to 170 ft.

(f) A Yellow preset altitude or "decision height" index which is moved around the dial through the complete range from -20 to 2500 ft by means of the knob marked with a triangle.

(g) A knob marked with a triangle in the lower RH corner enables :

- ON/OFF switching of indicator and control of OFF flag mask, by turning knob at beginning of scale (preset altitude index between approximately -10 and -15 ft).
- positioning of preset altitude index to altitude selected by the pilot.
- by pressing knob, opening of "decision height" relay contacts to the external DH warning light circuit.

(h) A test push-button in the lower LH corner, which is used for manual test of the system.

(i) During the test it is possible, by using the appropriate procedure, to activate the indicator aural warning which is sent to the audio warning system.

B. Operation (Ref. Fig. 005)

(1) The altitude pointer position on the dial is controlled by a potentiometer slider, the shaft of which is integral with the pointer and servomotor shafts.
The potentiometer is supplied with a reference voltage and its output voltage is a function of pointer position.
This voltage is compared with the voltage from the periodmeter in the transceiver. The comparison output is the error voltage which is amplified and used to drive the servomotor to the null point ; the pointer then gives a precise altitude indication.

(a) DH warning light control (Decision Height)

The 0 - 2500 ft dial pointer and the VDH potentiometer are mechanically controlled by the knob marked with a triangle.
From a reference voltage the potentiometer produces a voltage which is compared with a voltage proportional to altitude, an error voltage is produced, which is used for electronic control of the DH warning lights.
Pressing the control knob de-energizes the DH warning light control relay until it is again energized by :

- displacement of the index
- change of altitude

(b) Self monitoring

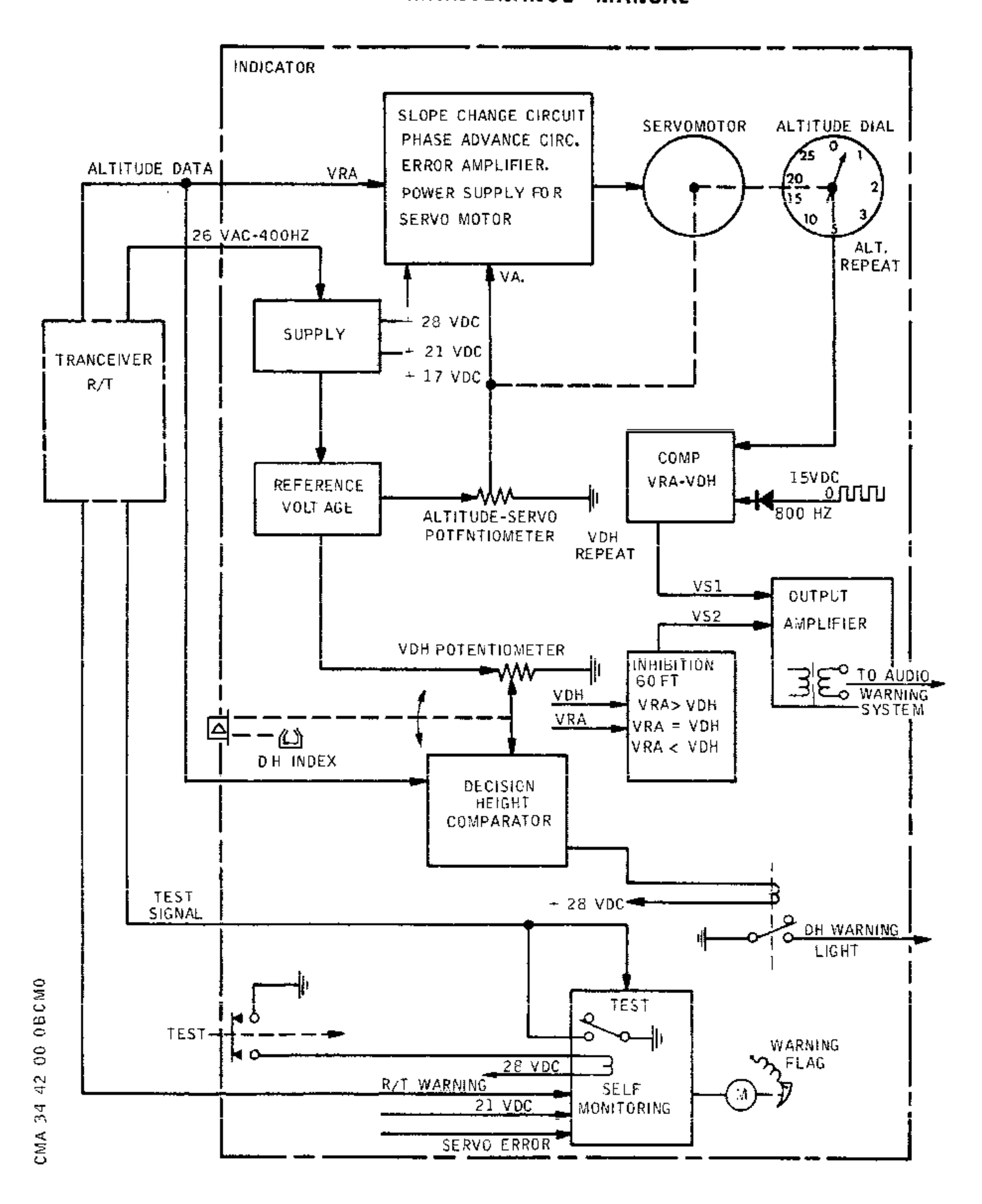
Continuously checks certain indicator valid signals and warning signals from the transceiver.
In case of a fault the self-monitor causes appearance of the indicator warning flag for :

- a power supply fault
- incorrect error voltage (transceiver voltage, pointer drive servomotor voltage)
- loss of transceiver valid signal

The flag, which is normally visible because of the action of a spring is held retracted by a motor controlled by the self monitor.

(c) Test operation

When the test push-button is held pressed the test configuration is activated on the indicator, the



Altitude Indicator - Operation Block Diagram
Figure 005

warning flag is visible, the pointer repeats the test voltage from the transceiver. If the decision height index has been positioned at 0 ft the aural warning sounds in the audio warning loud-speakers.

(d) Power supply

The regulated DC voltages required by the indicator are generated by two power supplies from 26V 400Hz from the transceiver unit. The internal circuitry is protected by a fuse in the primary of the transformer.
An unregulated 28VDC supplies the servomotor, the flag motor and the relay controlling the DH warning lights.

(e) Audio signal

In addition to the DH function the indicator has an audio signal circuit which sends an 800Hz ± 15% tone at the triggering altitude (ZDH + 60 ft), the amplitude of which varies inversely with the difference ZDH - DH selected. A flight altitude voltage repeat comparator repeats the decision height voltage (VDH) and produces a voltage which is applied to the audio signal electronics; the amplitude and polarity of the voltage control the activation and amplitude of the audio signal. The amplifier and inhibit circuitry complete the electronics. When the inhibit is not in operation the output amplifier sends audio signals through the indicator connector to the audio warning system.

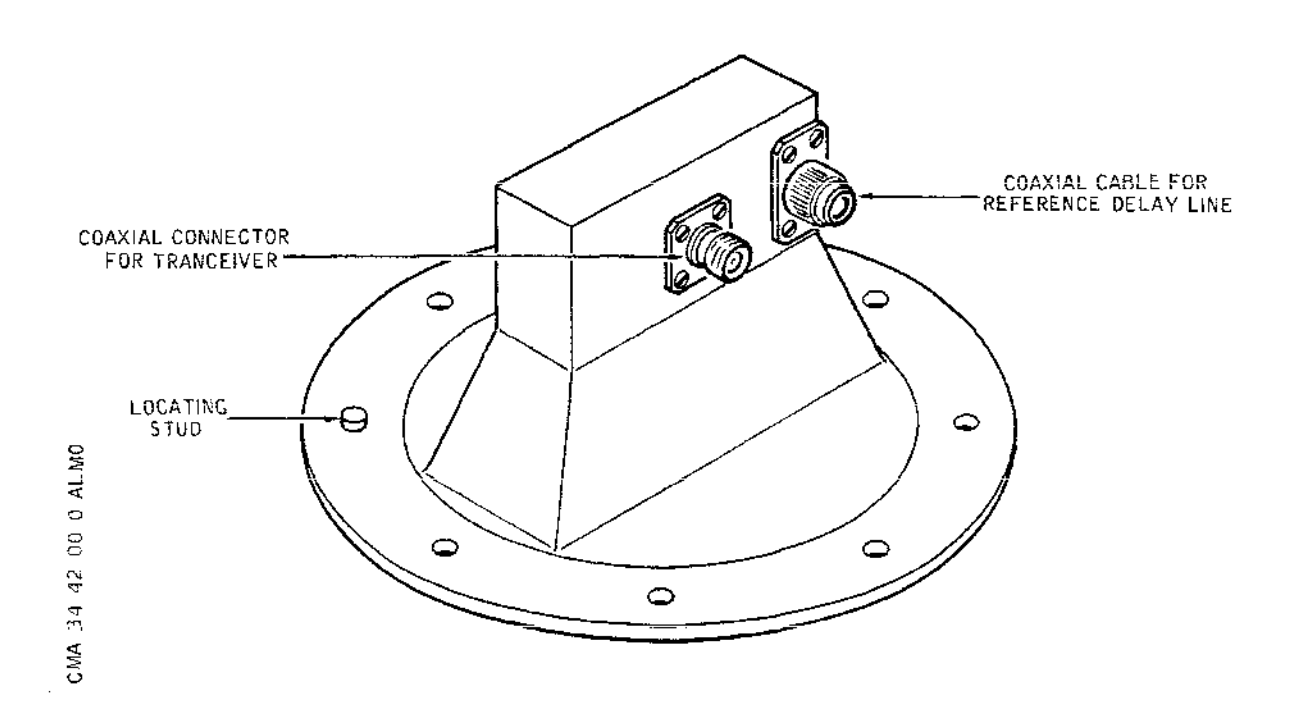
5. TRT AHV5-401 Antenna (Ref. Fig. 006)

The transmission and reception antennas are identical. The antenna is in the form of a truncated cone with a circular recessable base fitted with a locating stud. The face is flat. It is supplied through a coaxial connector connected to the transceiver. A second coaxial connector is connected to the reference delay line.

6. Operation
R (Ref. Fig. 007)

A. Switching and Normal Operation

Circuit breaker (1S56) or (2S56) being set, the 115 VAC - 400 Hz is applied to the transceiver (1S51) or (2S51).



Antenna - General View
Figure 006

After a time-delay supply voltages necessary to the operation of the system are distributed.

R On altitude indicator (1S53) or (2S53), when the start switch, controlled by the triangle marked knob, is closed, 26VAC is fed to indicator power supply which distributes the required voltages. Circuit breaker (S57) being set, the +28VDC signal is applied to the DIMMING MODULE (L1071C and L1072C).

On the altitude indicator, the warning flag disappears and the needle indicates the aircraft's altitude.

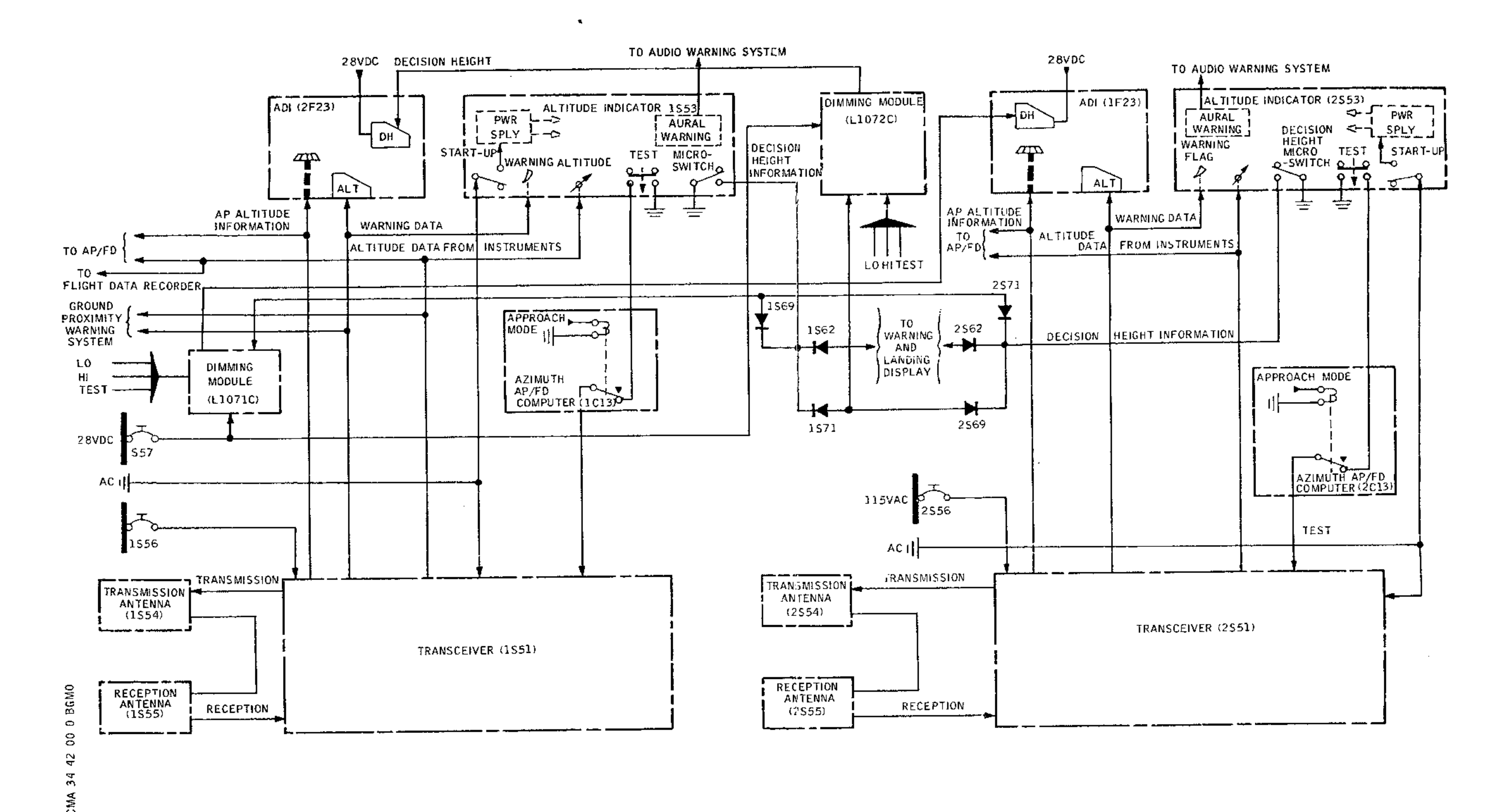
On the ground, this altitude is slightly negative because the system is set to display 0 feet at touch down.

After take-off and up to 2500 ft, the pointer indicates the aircraft's altitude with respect to the ground above which the aircraft is flying ; the warning flag is cleared.

In these flight conditions, appearance of warning flag on altitude and ADI indicators and loss of ground proximity warning validity signal indicates an incorrect reading due to any fault detected by the transceiver.

The altitude indication signal is simultaneously applied to :

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Radio Altimeter - System Operation Block Diagram
Figure 007

R

- The altitude indicator
- The AP/FD
- The peripheral systems (flight recorder and ground proximity warning system).
- The ADI indicators (the co-pilot ADI (2F23) receives information from transceiver (1S51) and the captain ADI (1F23) from transceiver (2S51)).

Above 2500 ft, the pointer of the altitude indicator is hidden behind its mask and the altitude information cannot be read but the warning system remains in operation and will display any failure detected.
As soon as the aircraft descends below 2500 feet, the pointer comes into view and indicates the aircraft's altitude.
Several features enable the following functions to be performed by the radio altimeter system.

- Failure detection
- Correct operation manual test
- Display and indicating of the decision height.

B. Failure Detection System Operation

When a unit or component (transceiver, co-axial cables, antennas, indicator) is defective it is indicated :

(1) By appearance of warning flag on :
- The altitude indicator
- The ADI indicator (the First Officer ADI (2F23) is monitored by transceiver (1S51), the captain ADI (1F23) by transceiver (2S51).

(2) By loss of validity signal to ground proximity warning system.
If the failure is detected in the transceiver or antenna circuit, the warning flag is visible on the altitude indicator and ADI and a loss of validity signal is sent to ground proximity warning system.
The altitude indicator needle is hidden behind its mask.

If the failure is detected in the altitude indicator, its warning flag is visible and the needle may indicate a wrong value.
However, despite this fault, the transceiver remains in operation and the following data from its outputs is correct :

- The altitude command signal issued to the peripheral circuits and ADI

- The altitude signal issued to the altitude indicator and peripheral circuits
- The warning signal issued to the ADI and to the ground proximity warning system.

If the failure is detected in the ADI, the radio altimeter system operates normally.

C. Operation of "Manual Test" Control

(1) On the altitude indicator, when TEST push-button is depressed, a ground signal is applied to the transceiver via the azimuth AP/FD computer (1C13 or 2C13) provided that APPR mode is not engaged.

(2) On the altitude indicator, the pointer is set between 0 and 100 feet at a test altitude, bench-adjusted according to the operator requirements ; in addition the warning flag is visible.

(3) If the APPR mode is engaged via the computer, the relay is energized and the ground signal cannot be transmitted to the transceiver and the test is inhibited.

(4) As soon as the TEST push-button is released, the "ground" signal is no longer applied and the altitude indicator pointer comes back to the aircraft's altitude with respect to the ground and the warning flag disappears.

R 011-011, 013-013, 015-015

(5) When the Decision Height index is positioned at 0 ft. the aural warning sounds in the Captain and First Officer audio warning loudspeakers.

D. Operation of the Pre-Selected Altitude System

On the altitude indicator, a movable index indicating the decision height can be positioned in front of any graduation. This index is controlled by means of the "preselected altitude" knob rotation.

(1) When the aircraft flies at an altitude greater than the pre-selected altitude, the "decision height" microswitch is open, the DH warning lights on the Captain and First Officer ADI's are extinguished, the dimming modules having no ground signal.

(2) When the aircraft flies at an altitude lower than the pre-selected altitude, the "decision height" micro-

switch is closed and the ground signal is transmitted to :

- The warning and landing display system (AFCS) via diode (2S62) for First Officer altitude indicator and diode (1S62) for captain altitude indicator.
- The "dimming modules" via diodes (2S69 and 2S71) for First Officer altitude indicator and diodes (1S69 and 1S71) for captain altitude indicator.
  The dimming modules receiving a ground signal, enable the +28 VDC to be applied to the DH warning lights which illuminate on the ADI.

(3) When preselected altitude knob is pressed, the altitude contacts no longer apply a ground and the ADI indicator lights "DH' extinguish, the ground is also removed from the warning and landing display.

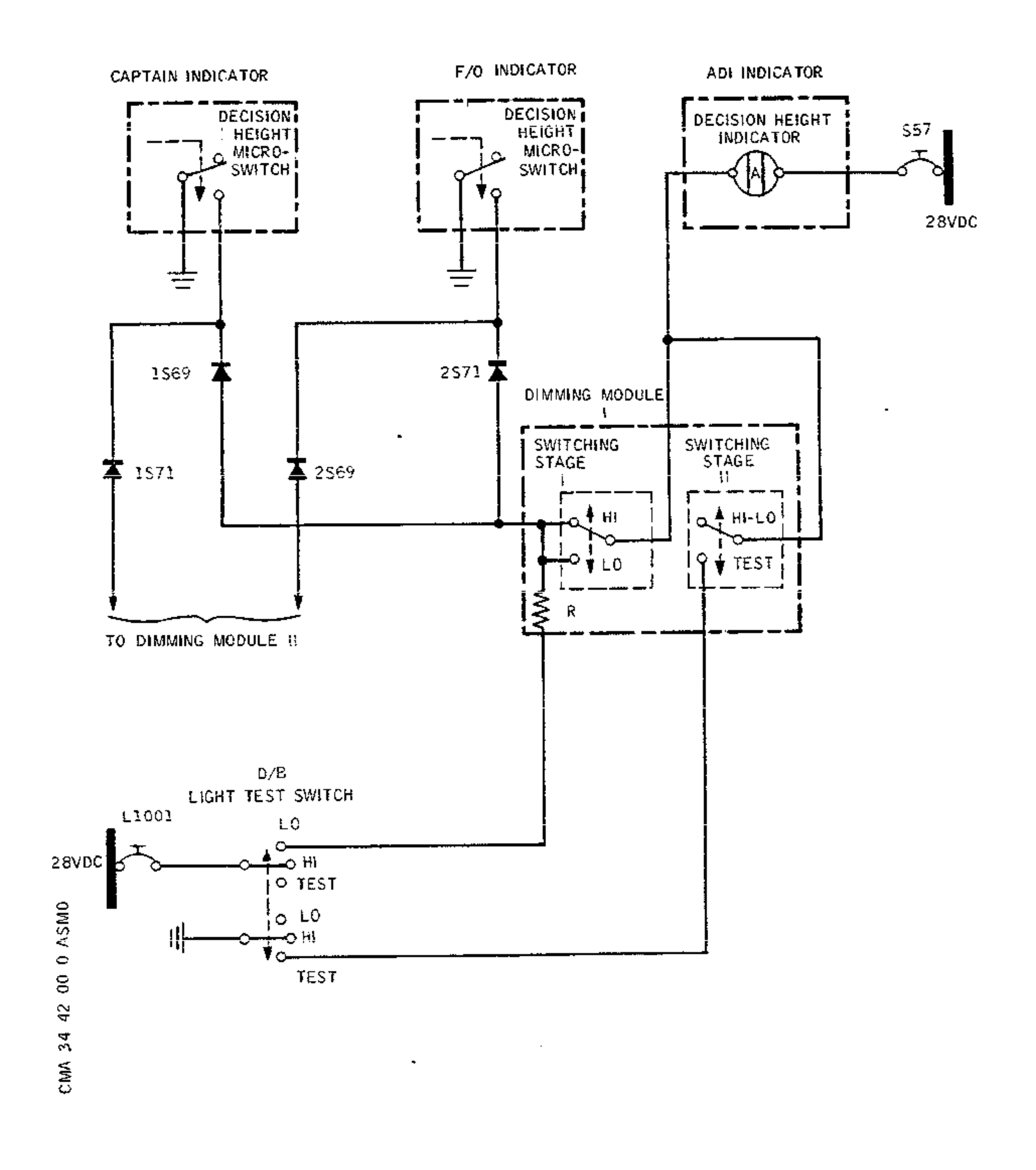
B NOTE : Indicators fitted post CM 42020, provide
B Decision Height warning tones through the Cap-
B tains and F/O's loudspeaker (via audio warning
B system amplifier). Warning tone will start when
B the aircraft is 70' above the MDA setting, in-
B creasing in intensity as the DH is approached.
B The tone will be removed when the aircraft rea-
B ches the DM, and the DH light will illuminate.
B The warning tone will stay off as long as the
B aircraft remains below DH, but will be initia-
B ted when the aircraft height equals the DH set-
B ting. The warning tone will then reduce in in-
B tensity as the aircraft climbs and will be
B renewed when the aircraft is 70 ft. above DH
B setting.

B (4) When descending, the aircraft reaches the
B selected Decision Height from above and the aural
B warning is activated. The volume of the tone from
B the audio warning system varies inversely with
B the difference between the altitude at which the
B warning is activated and the preselected altitude.

E. Associated Components

(1) Dimming Module (Ref. Fig. 008)

The dimming modules fitted in the radio altimeter system consist of electronics units providing automatic dimming or test of the DH warning light on the ADI (the schematic is simplified for easier comprehension ; for detailed schematics, refer chapter 33) These units are controlled by the altitude indicators



Radio Altimeter - Dimming Module
Operation Block Diagram
Figure 008

(altitude microswitch) and by a 3-position switch LO-HI-TEST and marked DB LIGHT TEST.
Circuit breakers (L1001 and S67) being set, the dimming modules are supplied according to the position of the DB LIGHT TEST switch.

(a) Switch in HI position

In the dimming modules, the switching stages I being in HI and stage II in HI-LO, the DH indicator light on the ADI is extinguished when "Decision height" microswitch is open. If a "Decision height" microswitch is closed, diodes (1S69, 2S71) or (2S69, 1S71) send a ground signal to the associated unit and the DH indicator light indicator illuminates on the ADI.

(b) Switch in LO position

In the dimming modules, the switching stages I being in LO and II in HI-LO, the DH indicator light on the ADI is extinguished when the "Decision height" microswitches are open, the voltage-dropping resistor is out of circuit, the DH indicator illuminates on the ADI as soon as the "Decision height" microswitch is closed, the resistor is switched in circuit and the DH warning light illuminates with less intensity than previously.

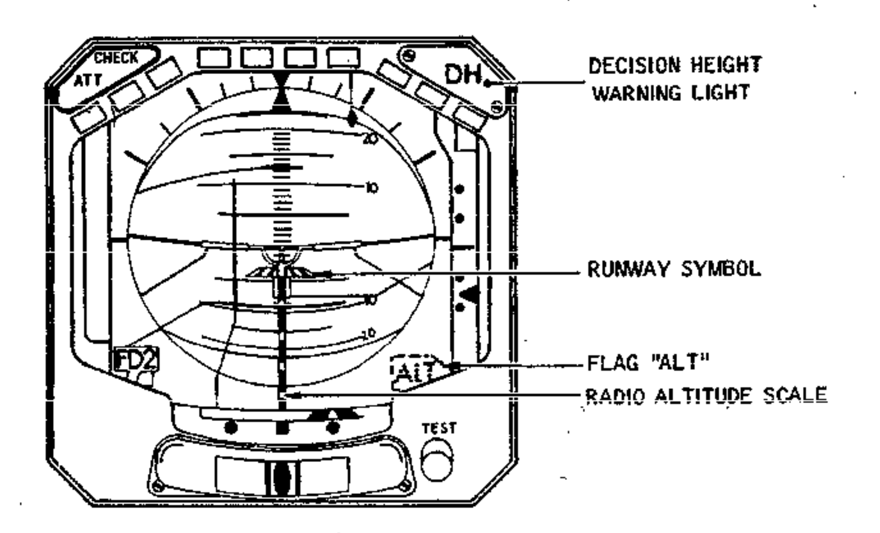
(c) Switch in TEST position

In the dimming modules, the switching stages II are in TEST and stage I is not energized.
The ground signal is directly applied to the DH indicator light which illuminates on the ADI.

(2) ADI Indicator (Ref. Fig. 009)

(a) Altitude Indication

The ADI indicator receives from the radio altimeter transceiver altitude data monitored by the integral altitude module which will transfer data only after the 240 ft threshold.
The altitude information appears on the ADI indicator in the form of an isosceles trapezium representing the runway in perspective.
This symbol moves behind a radio altimeter scale graduated from 0 to 240 feet.
When the upper side of the symbol coincides with the aircraft symbol, the altitude corresponds to



CMA 34 42 00 0 AUMO

ADI Indicator - ALT Flag Visible
Figure 009

that of the touchdown.

(b) Warning

If a failure occurs in the radio altimeter transceiver, the altitude symbol is cleared and a warning flag marked ALT appears in the lower RH corner of the ADI indicator. If the failure is originated in the ADI indicator, warning display is identical without any effect on the radio altimeter system which will display altitude indications on its specific indicators.

(c) DH Warning Lights

A warning light marked DH is fitted in the upper RH corner.
When the decision height displayed on the altitude indicator is reached, an external signal makes the DH warning light illuminate.

F. Operation Analysis of the Radio Altimeter System

(Ref. Fig. 010)

This figure contains a table providing information displayed according to the following operation configurations of the radio altimeter system :

- Normal operation
- Cut-out
- Failures
- Manual test

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FUNCTION →	INDICATOR NEEDLE	WARNING FLAG OF INDICATOR	FLAG CONTROL	ALTITUDE OUTPUT FROM INSTRUMENTS	AP ALTITUDE OUTPUT	AP WARNING	ALTITUDE MICROSWITCHES	ADI INDICATOR		
								WARNING FLAG	ALTITUDE POINTER	DECISION HEIGHT
LOCATION →	FACE OF INDICATOR	FACE OF INDICATOR	R/T (TRANSCEIVER) AND INDICATOR	R/T (TRANSCEIVER) AND INDICATOR WIRES	ON SOCKET OF R/T (TRANSCEIVER)	ON TRANSCEIVER	ON TRANSCEIVER	ON FACE OF INDICATOR	RUNWAY SYMBOL ON FACE	DH DECISION HEIGHT
OPERATION ↓						PRESENTLY UNUSED	PRESENTLY UNUSED			
NORMAL (-20 TO 2500FT)	VISIBLE AND INDICATES ALTITUDE	CLEARED	MAX. VOLTAGE (30V)	VOLTAGE INCREASING WITH ALTITUDE (0 TO 30V)	VOLTAGE INCREASING WITH ALTITUDE (0 TO 30V)	MAX. VOLTAGE (30V)	OPEN OR CLOSED ACCORDING TO ALTITUDE	CLEARED	VISIBLE FROM 0 TO 240 FT	ILLUMINATED OR EXTINGUISHED ACCORDING TO PRESELECTED ALTITUDE
BETWEEN 2500FT AND CUT-OUT	GRADUALLY DISAPPEARS BEHIND MASK	CLEARED	MAX. VOLTAGE (30V)	VOLTAGE GREATER THAN 26,174V (2500FT) WITH MAX. AT 30V	VOLTAGE GREATER THAN 26,174V (2500 FT) WITH MAX. AT 30 V	MAX. VOLTAGE (30V)	OPEN	CLEARED	CLEARED	EXTINGUISHED
NO SIGNAL (RADIO-ALTIMETER CUT-OUT)	HIDDEN BEHIND MASK	CLEARED	MAX. VOLTAGE (30V)	30V (APPROX. 3500FT)	30V (APPROX. 3500 FT)	MIN. VOLTAGE (0V)	OPEN	CLEARED	CLEARED	EXTINGUISHED
TRANSCEIVER MALFUNCTION	HIDDEN BEHIND MASK	VISIBLE	MIN. VOLTAGE (0V)	30V (APPROX. 3500 FT)	VOLTAGE INCREASING WITH ALTITUDE OR 30V (APPROX. 3500 FT)	MIN. VOLTAGE (0V)	OPEN	VISIBLE	CLEARED	EXTINGUISHED
FAILURE IN INDICATOR	HIDDEN BEHIND MASK	VISIBLE	MAX. VOLTAGE (30V)	VOLTAGE INCREASING WITH ALTITUDE OR MAX. AT 30V (3500FT)	30V (APPROX. 3500 FT)	MAX. VOLTAGE (30V)	OPEN OR CLOSED ACCORDING TO ALTITUDE	CLEARED	CLEARED	ILLUMINATED OR EXTING. ACCORDING TO PRESELECTED ALTITUDE
ANTENNA/CO-AXIAL CABLES DEFECTIVE	MASK BEHIND	VISIBLE	MIN. VOLTAGE (0V)	30V (APPROX. 3500 FT)	30V (APPROX. 3500 FT)	MIN. VOLTAGE (0V)	OPEN	VISIBLE	CLEARED	EXTINGUISHED
MANUAL TEST	SET TO TEST ALTITUDE (BETWEEN 0 AND 100FT)	VISIBLE	MIN. VOLTAGE (0V)	VOLTAGE CORRESPONDING TO TEST ALTITUDE (BETWEEN 0,2 AND 2,4V)	30V (APPROX. 3500 FT)	MIN. VOLTAGE (0V)	OPEN OR CLOSED ACCORDING TO TEST ALTITUDE	VISIBLE	CLEARED	ILLUMINATED OR EXTINGUISHED ACCORDING TO PRESELECTED ALTITUDE

CMA 34 42 00 0 AWM0

Radio Altimeter : Operation Analysis
Figure 010

RADIO ALTIMETER - TROUBLE SHOOTING

CAUTION : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of trouble shooting procedures and through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.
Bracketed numbers in the procedures and charts indicate items on the component identification table, (Ref, Table 101). The table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).
R As the two radio altimeter systems are similar, trouble shooting procedure is described for system 1 only. For trouble shooting of system 2, refer to identifiers and terms in parentheses.

R 2. Prepare

A. With aircraft on ground, LG locked, shock absorbers compressed.

B. On Captain instrument panel 2-211 :

(1) Check on radio altimeter indicator that the start knob
R is at counterclockwise stop.

(2) Place ATT INS1-INS3 switch in ATT INS1 position.

(3) Place NAV INS1-INS2 switch in NAV INS1 position.

R C. On First Officer instrument panel 2-212 :

(1) Check on radio altimeter indicator that the knob is at counterclockwise stop.

(2) Place ATT INS2-INS3 switch in ATT INS2 position.

(3) Place NAV INS1-INS2 switch in NAV INS2 position.

D. On glareshield instrument panel 5-211, make certain that on auto pilot control unit that no mode is engaged on the AP/FD.

E. Connect electrical ground power unit and energize the aircraft electrical network. (Ref, 24-41-00, Servicing).

F. Switch on electronics rack ventilation system (Ref. 21-21-00).

G. Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
ATT/INS 1ST PLT SW SUP		1F 13	G16
ADI 1ST PLT INS1 SUP & IND	2-213	1F 15	B 7
RAD ALT 1 SUP		1556	D 8
FLT CONT & NAV BUS 14XS		X 355	H 2
LH DASH INST LTS SUP	13-215	L 372	A12
RAD ALT 1 & 2 IND	15-215	S 57	C 5
PLT'S LT TEST SUP		L1001	E14
ADI 2ND PLT INS2 SUP & IND	13-216	2F 15	C13
RH DASH INST LTS SUP		L 371	E 9
RAD ALT 2 SUP		2556	F19
NAV INST 2 SUP 13XS		X 345	G 4
NAV/INS 2ND PLT SW SUP	15-216	2F 34	C 2
ATT/INS 2ND plt sw sup		2F 13	D21

H. On Captain side console 12-211, turn LH DASH INSTRUMENTS knob in clockwise direction integrated lighting in indicators illuminates.

I. On First Officer side console 5-212, turn RH DASH INSTRUMENTS knob in clockwise direction, integrated lighting in indicators illuminates.

J. Put interphone system into operation in order to connect ground service with flight compartment jacks (Ref. 23-41-00, Adjustment/Test).

NOTE 1.

- Altitude and flag information on Captain ADI is supplied by radio altimeter No.2 system, for First Officer ADI this information is supplied by radio altimeter No.1 system.
- DH indicator lights on Captain and First Officer ADI simultaneously illuminate, controlled either by radio altimeter system No.1 or No.2.

NOTE 2.

During removal of radio altimeter system 1 or 2 transceiver, make certain at rear of rack that the antenna coaxial cable securing nuts on two panel mounted coaxial connectors are normally locked. (Torque 48.658 to 70.776 lb. in, 0.55 to 0.8 m.daN).

K. Set the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
AUDIO WARN SYS SUP 1	1-213	W 371	M21
AUDIO WARN SYS SUP 2	5-213	W 372	C17

3. Trouble shooting

```
***************************************************
* On Captain side console 12-211, (First Officer    *
* 5-212) place and hold D/B LIGHT switch in TEST    *
* position. DH indicator light on Captain ADI ind-  *
* icator [1], (First Officer [2]) illuminates   IF  *
***************************************************
   ||     |     ------------------------------------------
   ||     |    | DH indicator light does not illuminate on |
   OK     NOT OK--| relevant indicator. Ref. Chart 101       |
   ||           ------------------------------------------
***************************************************
* Circuit breaker [3], ([4]) being set :            *
* (1) On radio altimeter, indicator [5], ([6]) on   *
*     Captain (First Officer) instrument panel, turn*
*     start knob in clockwise direction and select  *
*     decision height less than ground altitude and *
*     check that :                                  *
*     - black flag mask immediately disappears.     *
*     - warning flag disappears.                    *
*     - pointer indicates altitude approximately    *
*       zero ft.                                    *
```

```
* (2) On First Officer ADI indicator [2], (Captain  *
*     [1])                                          *
*     - ALT flag disappears                         *
*     - runway symbol is at stop and tangential to  *
*       aircraft symbol.                     IF     *
*****************************************************
    ||      |      ------------------------------------------------
    ||      |      | Black flag mask does not disappear, replace  |
    OK      NOT OK--| radio altimeter indicator [5], ([6]).        |
    ||      |      ------------------------------------------------
    ||      |      ------------------------------------------------
    ||      |      | Warning flag does not disappear on radio alti-|
    ||      |      | meter indicator and ADI of system in operat-  |
    OK      NOT OK--| ion. Ref. Chart 102                          |
    ||      |      ------------------------------------------------
    ||      |      | Warning flag does disappear on radio         |
    OK      NOT OK--| altimeter [5], ([6]) or on ADI indicator [2],|
    ||      |      | ([1]). Replace faulty indicator.             |
    ||      |      ------------------------------------------------
    f       |      ------------------------------------------------
    ||      |      | Ground altitude indication different on radio |
    OK      NOT OK--| altimeter indicator and ADI                  |
    ||             | Ref. Chart 103                               |
    ||             ------------------------------------------------
    ||
```

```
    ||
*****************************************************
* On Captain (First Officer) instrument panel, radio*
* altimeter [5], ([6]) press and hold TEST push     *
* button and check :                                *
* (1) On radio altimeter [5], ([6]) that :          *
*       - warning flag appears.                     *
*       - altitude pointer indicates 100 ft.        *
* (2) On ADI indicator [2], ([1]) that :            *
*       - warning flag appears.                     *
*       - runway symbol is masked.     IF           *
*****************************************************
    ||      |     ---------------------------------------------------
    OK      NOT OK--| Test inoperative. Ref. Chart 104                |
    ||      |     ---------------------------------------------------
    ||      |     ---------------------------------------------------
    ||      |     | Warning flag not visible on radio altimeter     |
    OK      NOT OK--| indicator [5], ([6]) or ADI [2], ([1]).         |
    ||      |     | Replace faulty indicator.                       |
    ||      |     ---------------------------------------------------
    ||      |     ---------------------------------------------------
    ||      |     | Warning flag not visible on radio altimeter and|
    OK      NOT OK--| ADI on radio altimeter system in operation.     |
    ||      |     | Replace transceiver [7], ([8]).                 |
    ||      |     ---------------------------------------------------
    ||      |     ---------------------------------------------------
    ||      |     | On ADI indicator, runway symbol and warning     |
    OK      NOT OK--| flag are visible.                               |
    ||      |     | Replace ADI indicator [2], ([1]).               |
    ||      |     ---------------------------------------------------
    ||      |     ---------------------------------------------------
    ||      |     | Radio altimeter indicator displays altitude     |
    OK      NOT OK--| different from 100 ft.                          |
    ||            | Ref. Chart 105                                  |
    ||            ---------------------------------------------------
*****************************************************
* On radio altimeter indicator [5], ([6]) release   *
* TEST push button and check that :                 *
* (1) Radio altimeter indicator indicates approxim- *
*     ately zero ft, warning flag is not visible.   *
* (2) On ADI indicator :                            *
*       - runway symbol is at stop and tangential to *
*         aircraft symbol.                          *
*       - warning flag is not visible.      If      *
*****************************************************
    ||      |
    ||      |
```

```
    ||      |
    ||      |         ----------------------------------------------------
    ||      |        | Warning flags visible on indicators.              |
    OK      NOT OK--| Ref. Chart 106.                                   |
    ||                ----------------------------------------------------
*****************************************************
* Reset circuit breakers [9], [10] [11], ([12]),    *
* [13], [14] on landing display.                    *
* On ADI indicators [1] and [2] and on Captain      *
* (First Officer) WLD, DH indicator lights are ext- *
* inguished.   IF                                   *
*****************************************************
    ||      |         ----------------------------------------------------
    ||      |        | DH indicator lights are illuminated on ADI ind-|
    ||      |        | icators [1] and [2] and on Captain (First Off- |
    ||      |        | icer) WLD.                                        |
    OK      NOT OK--| Replace radio altimeter indicator [5], ([6]).     |
    ||                ----------------------------------------------------
******************************************************
* On radio altimeter indicator [5], ([6]) turn      *
* decision height knob clockwise and set selection  *
* pointer to an altitude above ground altitude.     *
* DH indicator lights on Captain and First Officer  *
* ADI indicator and on Captain (First Officer) WLD  *
* illuminate.        IF                             *
*****************************************************
    ||      |         ----------------------------------------------------
    ||      |        | All DH indicator lights are extinguished.         |
    OK      NOT OK--| Replace radio altimeter indicator [5], ([6]).     |
    ||      |         ----------------------------------------------------
    ||      |
    ||      |         ----------------------------------------------------
    ||      |        | DH indicator light on Captain ADI indicator [1]|
    OK      NOT OK--| is extinguished. Ref. Chart 107                   |
    ||      |         ----------------------------------------------------
    ||      |
    ||      |         ----------------------------------------------------
    ||      |        | DH indicator light on First Officer ADI indic-   |
    OK      NOT OK--| ator [2] is extinguished. Ref. Chart 108          |
    ||      |         ----------------------------------------------------
    ||      |
    ||      |         ----------------------------------------------------
    ||      |        | DH indicator light on Captain (First Officer)    |
    OK      NOT OK--| WLD is extinguished. Ref. Chart 109               |
    ||      |         ----------------------------------------------------
    ||      |
    ||      |
```

```
   ||      |
   ||      |      -------------------------------------------------
   ||      |      | DH indicator light on First Officer (Captain)  |
   OK      NOT OK--| WLD indicator is illuminated. Ref. Chart 110   |
   ||             -------------------------------------------------
   ||
*****************************************************
* On radio altimeter indicator [5], ([6]) place     *
* decision height pointer to an altitude lower than *
* that of the aircraft on ground :                  *
* - DH indicator lights on Captain and First Officer*
*   ADI indicators and on Captain )First Officer)   *
*   WLD indicators extinguish.                      *
* Radio altimeter system is operational.            *
*****************************************************
```

```
*************************************-------------------------------
* DH INDICATOR LIGHT DOES NOT ILLUM- *| GROUND EQUIPMENT REQUIRED  |
* INATE ON INDICATOR CONCERNED.      *|----------------------------|
**************************************| DESCRIPTION       PART NO. |
                                      |----------------------------|
                                      | MULTIMETER                 |
                                      ------------------------------

****************************************************
* Place and hold D/B LIGHT switch on First Officer *
* 5-212, (Captain 12-211) side console in TEST pos- *
* ition and check that DH indicator light on ADI   *
* indicator concerned illuminates.                 *
****************************************************
     |       |      ---------------------------------------------
     |       |     | Trip circuit breaker [18].                  |
    NO      YES--| Replace faulty dimming module [16], ([17]). IF |
     |              ---------------------------------------------
     |                |       ------------------------------------
     |                |      | Replace faulty ADI indicator [1],  |
     |             NOT OK-| ([2]).                             |
     |                        ------------------------------------
****************************************************
* Check 28VDC at output of circuit breaker [15].    *
****************************************************
         |                              |
        NO                             YES
         |                              |
----------------------------------------------------------------------
| Replace circuit breaker [15]. || Trip circuit breaker [18].          |
--------------------------------| Replace faulty dimming module       |
                                | [16], ([17]).                       |
                                ---------------------------------------
```

Chart 101

Printed in England

```
*************************************-------------------------------
* WARNING FLAG DOES NOT DISAPPEAR ON *| GROUND EQUIPMENT REQUIRED  |
* RADIO ALTIMETER AND ADI INDICATORS *|-----------------------------|
* OF SYSTEM IN OPERATION             *| DESCRIPTION       PART NO. |
*************************************|-----------------------------|
                                     | MULTIMETER                  |
                                     -------------------------------
-----------------------------------------------------
| Check 115 VAC at output of circuit breaker [3],   |
| ([4]).                                            |
-----------------------------------------------------
     |      |
     |      |       ------------------------------------------------------
     |      |      | Trip circuit breaker [3], ([4]).                     |
    NO     YES---| Replace radio altimeter transceiver [7], ([8]).      |
     |              ------------------------------------------------------
     |
-----------------------------------------------------
| Replace circuit breaker [3], ([4]).               |
-----------------------------------------------------
```

Chart 102

```
**************************************
* GROUND ALTITUDE INDICATION DIFFE-  *
* RENT ON RADIO ALTIMETER AND ADI    *
* INDICATORS.                        *
**************************************

----------------------------------------------------
| Trip circuit breaker [3], ([4]).                 |
| Replace radio altimeter transceiver [7], ([8]). IF|
----------------------------------------------------
                         |
                       NOT OK
                         |
----------------------------------------------------
| Replace faulty radio altimeter [5], ([6]) or ADI |
| [2], ([1]) indicator.                            |
----------------------------------------------------
```

Chart 103

```
**************************************
* TEST DOES NOT OPERATE.             *
**************************************

-----------------------------------------------------
| Trip circuit breaker [3], ([4]).                  |
| Replace radio altimeter transceiver [7]. ([8]).   |
| Repeat TEST operation.                            |
-----------------------------------------------------
                          |
                          NO
                          |
-----------------------------------------------------
| Remove AZ-AP/FD computer [19], ([20]) and shunt   |
| pins 43 and 56 on connector AA.                   |
| Repeat TEST operation.                            |
-----------------------------------------------------
              |                          |
              NO                         YES
              |                          |
------------------------------ -------------------------------------
| Replace radio altimeter    | | Replace AZ-AP/FD computer [19],   |
| indicator [5], ([6]).      | | ([20]).                           |
------------------------------ -------------------------------------
```

Chart 104

```
**************************************
* RADIO ALTIMETER INDICATOR DISPLAYS *
* ALTITUDE DIFFERENT FROM 100 FT.    *
**************************************

-----------------------------------------------------
| Trip circuit breaker [3], ([4]).                  |
| Replace radio altimeter transceiver [7], ([8]).   |
-----------------------------------------------------
                        |
                        NO
                        |
-----------------------------------------------------
| Replace radio altimeter indicator [5], ([6]).     |
-----------------------------------------------------
```

Chart 105

****
* WARNING FLAGS VISIBLE ON INDICATORS*
****

On front panel of radio altimeter transceiver [7], ([8]) check indication on magnetic latching indicators RT and ANT. Carry out a reset operation by means of push-button at left of these indicators.

NO → RT magnetic latching indicator remains visible. Trip circuit breaker [3], ([4]). Replace radio altimeter transceiver [7], ([8]).

NO → ANT latching magnetic indicator remains visible. Replace radio altimeter reception antenna [21], ([22]).

NO → ANT magnetic latching indicator still visible, replace radio altimeter transmission antenna [23], ([24]).

NO → ANT magnetic latching indicator still visible, check antenna coaxial cables.

R NOTE : Antenna co-axial cable assemblies, including the
R antenna delay lines, are critical in their length
R and are manufactured to a close tolerance -
Ref. WDM 91-61-01.

Chart 106

```
**************************************
* DH INDICATOR LIGHT ON CAPTAIN ADI  *
* [1] IS EXTINGUISHED.               *
**************************************


*****************************************************
* Start up radio altimeter system 2 (radio altimeter*
* system 1).                                        *
* Select on First Officer radio altimeter indicator *
* [6], (Captain [5]) a decision height greater than *
* aircraft ground altitude.                         *
* DH indicator light on Captain ADI indicator illum-*
* inates.                                           *
*****************************************************
    |         |
    |         |    -------------------------------------------------
    |         |    | On junction box 7-216, loosen cover securing  |
    |         |    | screws and open cover.                        |
    |         |    | Remove printed circuit card on which diodes   |
   NO        YES--| and resistors are mounted.                     |
    |         |    | Replace diode [25], ([26]).                   |
    |              -------------------------------------------------
    |
-----------------------------------------------------
| Trip circuit breaker [18].                        |
| Replace dimming module [16].                   IF |
-----------------------------------------------------
                         |
                      NOT OK
-----------------------------------------------------
| Ref. 33-14-00, Trouble Shooting.                  |
-----------------------------------------------------
```

Chart 107

```
**************************************
* DH INDICATOR LIGHT ON FIRST OFFICER*
* ADI INDICATOR [2] IS EXTINGUISHED. *
**************************************


*****************************************************
* Start up radio altimeter system 2 (radio altimeter*
* system 1).                                        *
* Select on First Officer [6] (Captain [5]) radio   *
* altimeter indicator a decision height greater than*
* aircraft ground altitude,                         *
* DH indicator light on First Officer ADI illumin-  *
* ates.                                             *
*****************************************************
    |        |
    |        |    -------------------------------------------------
    |        |    | On junction box 7-216, loosen cover securing  |
    |        |    | screws and open cover.                        |
   NO       YES--| Remove printed circuit card on which diodes and|
             |    | resistors are mounted.                        |
    |             | Replace diode [27], ([28]).                   |
    |             -------------------------------------------------
    |
-----------------------------------------------------
| Trip circuit breaker [18].                        |
| Replace dimming module [17].                 IF   |
-----------------------------------------------------
                          |
                       NOT OK
                          |
-----------------------------------------------------
| Ref. 33-14-00, trouble shooting.                  |
-----------------------------------------------------
```

Chart 108

```
*************************************=============================
* DH INDICATOR LIGHT ON CAPTAIN      *| GROUND EQUIPMENT REQUIRED |
* (FIRST OFFICER) WLD IS EXTINGUISHED*|---------------------------|
**************************************| DESCRIPTION      PART NO. |
                                      |---------------------------|
                                      | MULTIMETER                |
                                      -----------------------------

*****************************************************
* On junction box 7-216, loosen cover securing      *
* screws and open cover.                            *
* Remove printed circuit card on which diodes and   *
* resistors are mounted. Using multimeter check     *
* diode [29], ([30]).                               *
*****************************************************
   |         |
   |         |    ------------------------------------------------
  NO        YES--| Ref. 22-41-00, Trouble shooting               |
   |              ------------------------------------------------
   |
   |
-----------------------------------------------------
| Replace diode [29], ([30]).                       |
-----------------------------------------------------
```

Chart 109

```
*************************************---------------------------------
* DH INDICATOR LIGHT ON FIRST OFFICER*| GROUND EQUIPMENT REQUIRED    |
* (CAPTAIN) WLD IS ILLUMINATES.      *|------------------------------|
*************************************| DESCRIPTION        PART NO. |
                                     |------------------------------|
                                     | MULTIMETER                   |
                                     --------------------------------

*****************************************************
* On junction box 7-216, loosen cover securing      *
* screws and open cover.                            *
* Remove printed circuit card om which are mounted  *
* diodes and resistors. Using multimeter check dio- *
* des [26] and [28], ([25] and [27]).               *
*****************************************************
     |         |
     |         |
     |         |      ---------------------------------------------------
    NO        YES--| Ref. 22-41-00, Trouble shooting.                  |
     |                ---------------------------------------------------
     |
     |
-----------------------------------------------------
| Replace faulty diode.                             |
-----------------------------------------------------
```

Chart 110

R 011-011, 013-013, 015-015

4. Trouble Shooting Aural Warning

```
****************************************************
* Radio altimeter aural warning : On Captain [5]   *
* (First Officer [6]) radio altimeter indicator se- *
* lect decision height 0 ft. Press and hold T push- *
* button : check that aural warning sounds in       *
* Captain and First Officer audio warning loudspea- *
* kers.                                             *
****************************************************
   ||    |          --------------------------------------------------
   ||    |         | Aural warning does not sound in loudspeakers     |
   OK    NOT OK----| (AWS operates correctly). Replace faulty radio   |
   ||              | altimeter indicator [5] ([6]).                   |
   ||               --------------------------------------------------
****************************************************
* Hold T push-button pressed and turn decision     *
* height push-button until a height of 100 ft. or  *
* greater is indicated. Aural warning ceases.      *
****************************************************
   ||    |          --------------------------------------------------
   OK    NOT OK----| Aural warning continues. Replace faulty radio    |
   ||              | altimeter [5] ([6]).                             |
   ||               --------------------------------------------------
****************************************************
* Trip circuit breakers [31] ([32]).               *
****************************************************
```

	ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
R	[1] Indicator ADI, Captain		2-211	1F23	Flight compart-ment	34-23-12 R/I	34-42-01
R	[2] Indicator ADI, First Officer		2-212	2F23	Flight compart-ment	34-23-12 R/I	34-42-01
	[3] Circuit breaker-115VAC		2-213	1S56	Map Ref. D7 or D8	24-50-00 R/I	34-42-01
	[4] Circuit breaker-115VAC		13-216	2S56	Map Ref. F19	24-50-00 R/I	34-42-01
R	[5] Indicator radio-altimeter		2-211	1S53	Flight compart-ment	34-42-31 R/I	34-42-01
R	[6] Indicator radio-altimeter		2-212	2S53	Flight compart-ment	34-42-31 R/I	34-42-01
R	[7] Transcei-ver-radio-altimeter	DOOR 811	131 FR 38	1S51	Lower bag-gage com-partment LH	34-42-41 R/I	34-42-01
R	[8] Transcei-ver-radio-altimeter	DOOR 811	132 FR 38	2S51	Lower bag-gage com-partment RH	34-42-41 R/I	34-42-01
	[9] Circuit breaker-28VDC		1-213	1C192	Map Ref. P13	24-50-00 R/I	
	[10 Circuit breaker-28VDC		1-213	1C193	Map Ref. P14	24-50-00 R/I	
	[11] Circuit breaker-115VAC		2-213	1C191	Map Ref. F04	24-50-00 R/I	
	[12] Circuit breaker-28VDC		5-213	2C192	Map Ref. B11	24-50-00 R/I	

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[13] Circuit breaker-28VDC		5-213	2C193	Map Ref. B12	24-50-00 R/I	
[14] Circuit breaker-115VAC		13-216	2C191	Map Ref. F16	24-50-00 R/I	
[15] Circuit breaker-28VDC		15-215	S57	Map Ref. C5	24-50-00 R/I	34-42-01
[16] Dimming module		1-211	L1071C	Flight compart-ment		33-14-04 34-42-01
[17] Dimming module		1-212	L1072C	Flight compart-ment		33-14-04 34-42-01
[18] Circuit breaker-28VDC		15-215	L1001	Map Ref. E 14	24-50-00 R/I	33-14-04
[19] Computer No.1 AP-AP/FD		4-215	1C13	Fwd elect-ronics rack	22-13-11 R/I	34-42-01
[20] Computer No.2 AZ-AP/FD		4-216	2C13	Fwd elect-ronics rack	22-13-11 R/I	34-42-01
[21] Antenna-reception		191 FR 38-39	1S55	Fillets (lower) LH	34-12-31 R/I	34-42-01
[22] Antenna-reception		192 FR 38-39	2S55	Fillets (lower) RH	34-12-31 R/I	34-42-01
[23] Antenna-transmission		191 FR 39-40	1S54	Fillets (lower) LH	34-12-31 R/I	34-42-01
[24] Antenna-transmission		192 FR 39-40	2S54	Fillets (lower) RH	34-12-31 R/I	34-42-01

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
[25] Diode		7-216	1S69	Fwd electronics rack		34-42-01
[26] Diode		7-216	2S71	Fwd electronics rack		34-42-01
[27] Diode		7-216	1S71	Fwd electronics rack		34-42-01
[28] Diode		7-216	2S69	Fwd electronics rack		34-42-01
[29] Diode		7-216	1S62	Fwd electronics rack		34-42-01
[30] Diode		7-216	2S62	Fwd electronics rack		34-42-01
[31] Circuit breaker	28VDC	1-213	W371	Map ref M 21		34-23-00
[32] Circuit breaker	28VDC	5-213	W372	Map ref C 17		34-23-00

Component Identification
Table 101

RADIO ALTIMETER SYSTEM - MAINTENANCE PRACTICES

1. Cat 3 autoland

In order to obtain maximum utilisation of the CAT 3 capability, the Radio Altimeter systems must be maintained in a fully serviceable condition.

Unless maintenance action can positively be identified as curing a defect, the Autoland system must be downgraded. The CAA require that in the event of any Radio Altimeter System malfunction or reported defect, the Radio Supervisor must liase with the appropriate Instrument Supervisor who will down grade the system as necessary.

For full information on Autoland Regrading procedures, refer to Maintenance Manual 22-00-00 (Maintenance Practices).

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
1 Electrical Ground Power Unit	

B. Prepare

(1) The aircraft will be on the ground with landing gear downlocked and shock-absorbers compressed. Preferably place the aircraft outside, in a zone clear of obsta-
R cles within a vertical cone of 60° with respect to its
R axis (the apex of the cone being one of the system antennas).

(2) On Captain's instrument panel 2-211 :

(a) Make certain that triangular knob on radio altimeter indicator is turned fully counterclockwise.

(b) Place ATT INS1-INS3 switch (1F7) in ATT INS1 position.

(c) Place NAV INS1-INS2 switch (1F33) in NAV INS1 position.

(3) On First Officer's instrument panel 2-212 :

(a) Make certain that triangular knob on radio altimeter indicator is turned fully counterclockwise.

(b) Place ATT INS2-INS3 switch (2F7) in ATT INS2 position.

(c) Place NAV INS1-INS2 switch (2F33) in NAV INS2 position.

(4) On panel 5-211, on auto-pilot control unit make certain that no mode is selected on the auto-pilots/flight directors.

(5) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(6) Switch on electronics rack ventilation (Ref. 21-21-00).

(7) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
ATT/INS 1ST PLT SW SUP		1F 13	G16
ADI 1ST PLT INS 1 SUP & IND	2-213	1F 15	B 7
RAD ALT 1 SUP		1S 56	D 8
FLT CONT & NAV BUS 14XS		X 355	H 2
LH DASH INST LTS SUP	13-215	L 372	A12
RAD ALT 1 & 2 IND	15-215	S 57	C 5
PLT'S LT TEST SUP		L1001	E14
ADI 2ND PLT INS2 SUP & IND	13-216	2F 15	C13
RH DASH INST LTS SUP		L 371	E 9
RAD ALT 2 SUP		2S 556	F19
NAV INST BUS 13XS			
NAV/INS 2ND PLT SW SUP	15-216	2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21

C. Tests

(1) Lighting check.

(a) On Captain's instrument panel 12-211 :

(a1) Turn LH DASH INSTRUMENT knob clockwise, integral indicator lighting illuminates.

(a2) Place and hold D/B LIGHT (LO-HI-TEST) switch in TEST position, DH warning light on Captain's ADI illuminates.

(a3) Release D/B LIGHT (LO-HI-TEST) Switch, DH warning light on Captain's ADI extinguishes.

(b) On First Officer instrument panel 5-212 :

(b1) Turn RH DASH INSTRUMENTS knob clockwise,

integral indicator lighting illuminates.

(b2) Place and hold D/B LIGHT (LO-HI-TEST) switch in TEST position DH warning light on First Officer's ADI illuminates.

(b3) Release D/B LIGHT (LO-HI-TEST) switch, DH warning light on First Officer's ADI extinguishes.

(2) Starting of Radio Altimeter No.1 (No.2).

NOTE: As both systems are similar, only system 1 test is described, system 2 identifiers are included in parentheses. Note that Captain ADI is operated by radio altimeter No.2 and First Officer ADI is operated by radio altimeter No.1.

(a) On panel 2-211 (2-212), on Captain's radio altimeter indicator, turn triangular knob clockwise and set decision height index (triangular Yellow index) to 50 ft and check:

RB (a1) On indicator that red warning flag mask disappears immediately.

(b) After switch-on of radio altimeter under test (resetting of circuit breakers) and after time delay of 10 seconds make certain:

(b1) On Captain's (First Officer's) instrument panel 2-211 (2-212) that:

- On radio altimeter indicator warning flag disappears and pointer indicates altitude less than 0 ft
- On ADI DH warning light illuminates.

(b2) On First Officer's (Captain's) instrument panel 2-212 (2-211), that on ADI:

- DH warning light illuminates
- ALT flag disappears
- The runway symbol (isosceles trapezium) is against stop and tangential with outer edge of aircraft symbol.

(c) On Captains console 12-211, place D/B LIGHT (LO-HI-TEST) switch in LO position:

- On Captain's ADI DH warning light is dimmed.

(d) Place D/B LIGHT (LO-HI-TEST) switch in HI position DH warning light brightness increases.

(e) On First Officer's console 5-212, place D/B LIGHT (LO-HI-TEST) switch in LO position:

- On First Officer's ADI (panel 2-212), DH warning light is dimmed.

(f) Place D/B LIGHT (HI-LO-TEST) switch in HI position DH warning light brightness increases.

(3) Self-test of Radio Altimeter No.1 (No.2).

(a) Check of radio altimeter aural warning.

(a1) Make certain that the following circuit breakers are set:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
AUDIO WARN SYS SUP 1	1-213	W 371	M21
AUDIO WARN SYS SUP 2	5-213	W 372	C17

RB (a2) On Captain's (First Officer's) radio
RB altimeter indicator select decision height
RB index to fully counter clockwise position.

RB (a3) On Captain's (First Officer's) radio
RB altimeter indicator press then release test
RB push-button, aural warning sounds in audio
RB warning system loudspeakers.

RB (a4) Press and hold test button again whilst
RB rotating the height index slowly to 100 ft
RB or greater. Ensure aural warning increases
RB steadily in volume and ceases when index
RB passes needle tip.

(a5) Release test push-button.

(a6) Trip the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
AUDIO WARN SYS SUP 1	1-213	W 371	M21
AUDIO WARN SYS SUP 2	5-213	W 372	C17

(b) Check of radio altimeter warning to Warning and Landing Display System.

NOTE : The test is described in single radio altimeter operation configuration.

(b1) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
WARN & LDG DISPLAY 1 SUP 1	1-213	1C 192	P13
WARN & LDG DISPLAY 1 SUP 2		1C 193	P14
LDG DISPLAY SYS 1 SUP	2-213	1C 191	F04
WARN & LDG DISPLAY 2 SUP 1	5-213	2C 192	B11
WARN & LDG DISPLAY 2 SUP 2		2C 193	B12
LDG DISPLAY SYS 2 SUP	13-216	2C 191	F16

- On Captain's (First Officer's) instrument panel, on WLD indicator, DH warning light illuminates.

(b2) On Captain's (First Officer's) radio altimeter indicator, set decision height 200 ft and make certain that :

- On Captain's (First Officer's) instrument panel :

  - ADI DH warning light illuminates
  - WLD indicator DH warning light is illu-

minated.

RB (b3) On First Officer's (Captain's) instrument panel, ADI DH warning light is illuminated.

(c) On Captain's (First Officer's) radio altimeter indicator, press and hold T push-button:

(c1) On Captain's (First Officer's) instrument panel, check that:

- ADI DH warning light remains illuminated
- WLD indicator DH warning light goes off
- Radio altimeter indicator pointer indicates altitude 100 ± 4 ft, and warning flag is visible.

RB (d) On First Officer's (Captain's) instrument panel, check on ADI indicator that:

- The runway symbol disappears
- ALT flag appears
- DH warning light remains illuminated.

(e) On Captain's (First Officer's) radio altimeter indicator bring back decision height to 0 ft while pressing and holding T push-button, and check that:

- Captain's and First Officer's ADI DH warning lights go off.

(f) On Captain's ('First Officer's') radio altimeter indicator, release T push-button:

(f1) On Captain's (First Officer's) radio altimeter indicator:

- Warning flag disappears
- Pointer reaches upper stop then after several seconds indicates altitude 0 ft or less.

(f2) On Captain's and First Officer's ADI indiators, DH warning lights remain illuminated.

RB (f3) On First Officer's (Captain's) ADI:

- ALT flag disappears
- Runway symbol is against stop and tangential with outer edge of aircraft symbol

circle.

(f4) On Captain's (First Officer's) WLD indicator, DH warning light illuminates.

(g) On Captain's (First Officer's) radio altimeter, press then release decision height selection and start knob and check that:

(g1) Captain's (First Officer's) ADI DH warning lights go off.

(g2) Captain's (First Officer's) WLD DH warning light goes off.

(h) Trip radio altimeter No.1 (No.2) power supply circuit breaker and check that:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD ALT 1 SUP	2-213	1S 56	D 8
RAD ALT 2 SUP	13-216	2S 56	F19

(h1) On Captain's (First Officer's) radio altimeter:

- Warning flag appears.
- Pointer remains in previous position.

(h2) On Captain's and First Officer's ADI indicators that:

- DH warning light extinguishes.

(h3) On First Officer's (Captain's) ADI that:

- ALT warning flag appears.
- Runway symbol disappears.

(i) On Captain's (First Officer's) radio altimeter indicator, turn decision height knob to counter-clockwise stop:

B (i1) On radio altimeter indicator under
RB test, check that the red warning flag
RB continues to be displayed.

D. Close-Up

(1) Trip the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(2) On panel 12-211 (Captain's console):

(a) Turn LH DASH INSTRUMENTS knob fully counterclockwise. Indicator integral lighting goes off.

(3) On panel 5-212 (First Officer's console):

(a) Turn RH DASH INSTRUMENTS knob fully counterclockwise. Indicator integral lighting goes off.

(4) Switch-off electronics rack ventilation (Ref. 21-21-00).

(5) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

RB (6) Reset the following circuit breakers:

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RB	RAD ALT 1 SUP	2-213	1S 56	D 8
RB	RAD ALT 2 SUP	13-216	2S 56	F19
RB	AUDIO WARN SYS SUP 1	1-213	W371	M21
RB	AUDIO WARN SYS SUP 2	5-213	W372	C17

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Headset for Interphone	TE 2037000
Radio Altimeter Ground Test Unit (TRT-AHV5-018)	

B. Prepare

Repeat Prepare procedure in operational test, Ref. Paragraph 1.B.

C. Tests

(1) Lighting check

Repeat procedure in operational test, Ref. paragraph 1.C.(1).

(2) Start up of radio altimeter No.1 (No.2).

Repeat procedure in operational test, Ref. paragraph 1.C.(2).

(3) Self-test of radio altimeter No.1 (No.2).

Repeat procedure in operational test, Ref. paragraph 1.C.(3).

(4) Test of radio altimeter No.1 (No.2) with ground test unit.

(a) On panel 15-215 trip circuit breaker RAD ALT 1 & 2 IND, S57, map Ref. C5.

(b) On ground test unit, connect both test antennas to delay line by means of coaxial cables W309.

(c) In zone 191, LH wing (zone 192, RH wing) place two test antennas under reception antenna 1S55 and transmission antenna 1S54 (2S55, 2S54) on aircraft taking care that cone apertures are exactly facing each other (coaxial connector of cone towards

aircraft side).

(d) Connect TEST connector of ground test unit to TEST connector on front panel of transceiver No.1 (1S51) [No.2, (2S51)], in zone 131, accessible by access door 811, by means of coaxial cable W307.

NOTE: Make certain that test cable connector is not locked, the mark on socket should not appear in line with red mark in slot of knurled sleeve.

- Plug connector in ground test unit base, taking care to position the red mark on sleeve between the two red marks engraved on base outer part. Push sleeve and turn clockwise an eighth of a turn.

(e) On ground test unit, make certain that SIMULATOR ON-OFF switch is placed in OFF position.

(f) In order to check the correspondence between the values read on ground test unit and the values read on indicators in flight compartment, establish communication by means of the interphone between ground service jacks and flight compartment (Ref. 23-41-00, Adjustment/Test).

(g) Reset the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD ALT 1 SUP	2-213	1S 56	D 8
RB RAD ALT IND 1 & 2 SUP	15-215	S 57	C 5
RAD ALT 2 SUP	13-216	2S 56	F19

(h) On Captain's (First Officer's) radio altimeter indicator, turn triangular knob clockwise and set the decision height triangular Yellow pointer to 0 ft and check that:

(h1) On ground test unit:

- ALARM warning light illuminates
- The voltmeter reads 30 volts

(h2) Check on Captain's (First Officer's) radio altimeter indicator :

- The warning flag is visible
- The altitude displayed is above 2500 ft.

(i) After a few seconds check :

(i1) On ground test unit that :

- ALARM warning light goes off
- The voltmeter reads a voltage corresponding to an altitude of 100 ft (Ref. altitude-voltage conversion table attached to ground test unit cover)

(i2) On Captain's (First Officer's) radio altimeter indicator that :

- The warning flag disappears
- The pointer reads an altitude of 100 ft approximately.

(i3) On First Officer's (Captain's) ADI that :

- ALT flag is not visible
- The runway symbol indicates an altitude of 100 ft approx. (reading on scale graduated in 50 ft increments on symbol).

(j) On ground test unit place :

(j1) Turn minus-plus potentiometer to minus stop.

(j2) Place SIMULATOR ON-OFF switch in ON position.

(k) Check on indicators :

(k1) On Captain's (First Officer's) radio altimeter that the pointer reads an altitude of 0 ft approximately.

(k2) On First Officer's (Captain's) ADI that the runway symbol is against stop and tangential with outer periphery of aircraft symbol.

(l) On ground test unit, slowly turn minus-plus potentiometer clockwise to cover the 0 to 2500 ft range. Every 200 ft check :

(l1) On First Officer's (Captain's) ADI that the

runway symbol moves downwards, then disappears at an altitude of 240 ft.

(l2) the correspondence between the altitude read on Captain's (First Officer's) radio altimeter indicator and the voltage read on ground test unit voltmeter

NOTE : Use voltage-altitude conversion table.

(m) On Captain's (First Officer's) radio altimeter indicator, using decision height knob set decision height of 500 ft.

(n) On ground test unit, turn minus-plus potentiometer counterclockwise, then check that when simulated altitude overrides decision height pointer :

R (n1) DH warning light on Captain's and First Officer's ADI illuminates.

(o) On Captain's (First Officer's) radio altimeter indicator using decision height knob, set decision height to 0 ft and check that :

R (o1) DH warning light on Captain's and First Officer's ADI extinguishes approximately 15
R ft below altitude indicated by radio altimeter indicator pointer.

(p) On ground test unit, turn minus-plus potentiometer counterclockwise to set an altitude of 0 ft, check :

(p1) On Captain's (First Officer's) instrument panel that :

- Radio altimeter indicator reads 0 ft
R - On ADI, DH warning light illuminates

(p2) On First Officer's (Captain's) instrument panel, on ADI :

- The runway symbol moves upwards from 240 ft and becomes tangential with aircraft symbol at 0 ft
R - DH warning light illuminates

(q) Trip radio altimeter No.1 (No.2) circuit breaker
R and check that :

SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
RAD ALT 1 SUP	2-213	1S	56	D 8
RAD ALT 2 SUP	13-216	2S	56	F19

(q1) On Captain's (First Officer's) radio altimeter indicator:

- Warning flag appears.
- Pointer remains in previous position.

(q2) On Captain's (First Officer's) ADI that DH warning light extinguishes.

(q3) On First Officer's (Captain's) ADI:

- ALT warning flag appears.
- Runway symbol disappears.
- DH warning light extinguishes.

(r) On Captain's (First Officer's) radio altimeter indicator turn decision height knob counterclockwise:

(r1) On radio altimeter indicator under test, the
RB red warning flag appears.

(s) On panel 15-215 trip circuit breaker RAD ALT 1 & 2 IND, S57, map ref. C5.

B (t) Additional checks to be carried out if "flag in
B cruise reported".
B Remove the Test Antennas from aircraft and blank
B off the Tx Antenna with Radar Absorbent Matting
B (Eccosorb AN-W75-ML). This removes the ground
B return signal thereby simulating the in cruise
B condition. The reported defect can now be
B investigated. The flag should remain out of view
B at all times.

D. Close-Up

(1) Disconnect TEST cable connector from TEST connector on front panel of radio altimeter No.1 (No.2) transceiver.

(2) Remove test antennas from LH (RH) wing.

(3) Disconnect test antennas from delay line, test cable from TEST connector on ground test unit and place all accessories in test set.

(4) Disconnect headsets and switch off interphone system (Ref. 23-41-00, Adjustment/Test).

(5) On panel 12-211, LH side console, turn LH DASH INSTRUMENTS knob to counterclockwise stop, indicator integral lighting goes off.

(6) On panel 5-212, RH side console, turn RH DASH INSTRUMENTS knob to counterclockwise stop, indicator integral lighting goes off.

(7) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(8) Switch off electronics rack ventilation system (Ref. 21-21-00).

(9) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

3. System test

Repeat procedure in functional test, Ref. paragraph 2.

RB 4. No. 1 and No. 2 RADIO ALTIMETER TRANSIT CHECK

RB A. Check

RB (1) Indication reads between -5' and -12' with flag
RB hidden, also, opposite ADI runway symbol in view with
RB 'ALT' flag hidden.

RB (2) MDA bug set behind mask, operate self test and check
RB indication 100' ± 5' with flag in view and opposite
RB ADI 'ALT' flag in view with runway symbol hidden.

RB (3) Release self test button and check indicator goes to 2500', then returns to original reading with MDA aural warning sounded with flags clear.

RB (4) Set MDA bug above pointer, check aural warning ceased with MDA lights on both ADI's and own annunciator panel illuminated.

R
1. General

Two indicators are installed, on the Captain and First Officer instrument panels. Because of insufficient wiring length, the connectors of these indicators shall be disconnected after removing the relevant glareshield panel, after which the indicators shall be withdrawn from the front.

R 2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On LH and RH side panels 12-211 and 5-212 make certain that :

(a) LH and RH DASH INSTRUMENTS knobs are in OFF position.

(b) On radio altimeter indicators that the triangle marked knob is at counterclockwise stop.

(2) On panel 5-211, AFCS control unit, make certain that no AP/FD mode is engaged.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD ALT1 SUP	2-213	1S 56	D 8
FLT CONT & NAV BUS 14XS		X 355	H 2
LH DASH INST LTS SUP	13-215	L 372	A12
RH DASH INST LTS SUP	13-216	L 371	E 9
RAD ALT2 SUP		2S 56	F19

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV INST BUS 13XS		X 345	G 4

R

C. Remove (Ref. Fig. 401)

(1) On Captain or First Officer instrument panel (3), release dzus fasteners (2) attaching glareshield panel (1).

(2) Lift glareshield panel partially, then gain access under glareshield panel and disconnect aircraft connector (5) from rear connector (10) on indicator (6).

(3) Loosen and remove the four adaptor plate (9) mounting screws (7).

(4) Remove adaptor plate (9).

(5) Release indicator (6) from its seating (4) and withdraw.

(6) Cap connectors (5) and (10).

D. Preparation of Replacement Component

(1) Make certain that indicator seating is clean and that aircraft wiring and connectors are in good condition.

(2) Make certain that indicator is in good external condition and that its connectors are undamaged and have no trace of corrosion.

E. Install
(Ref. Fig. 401)

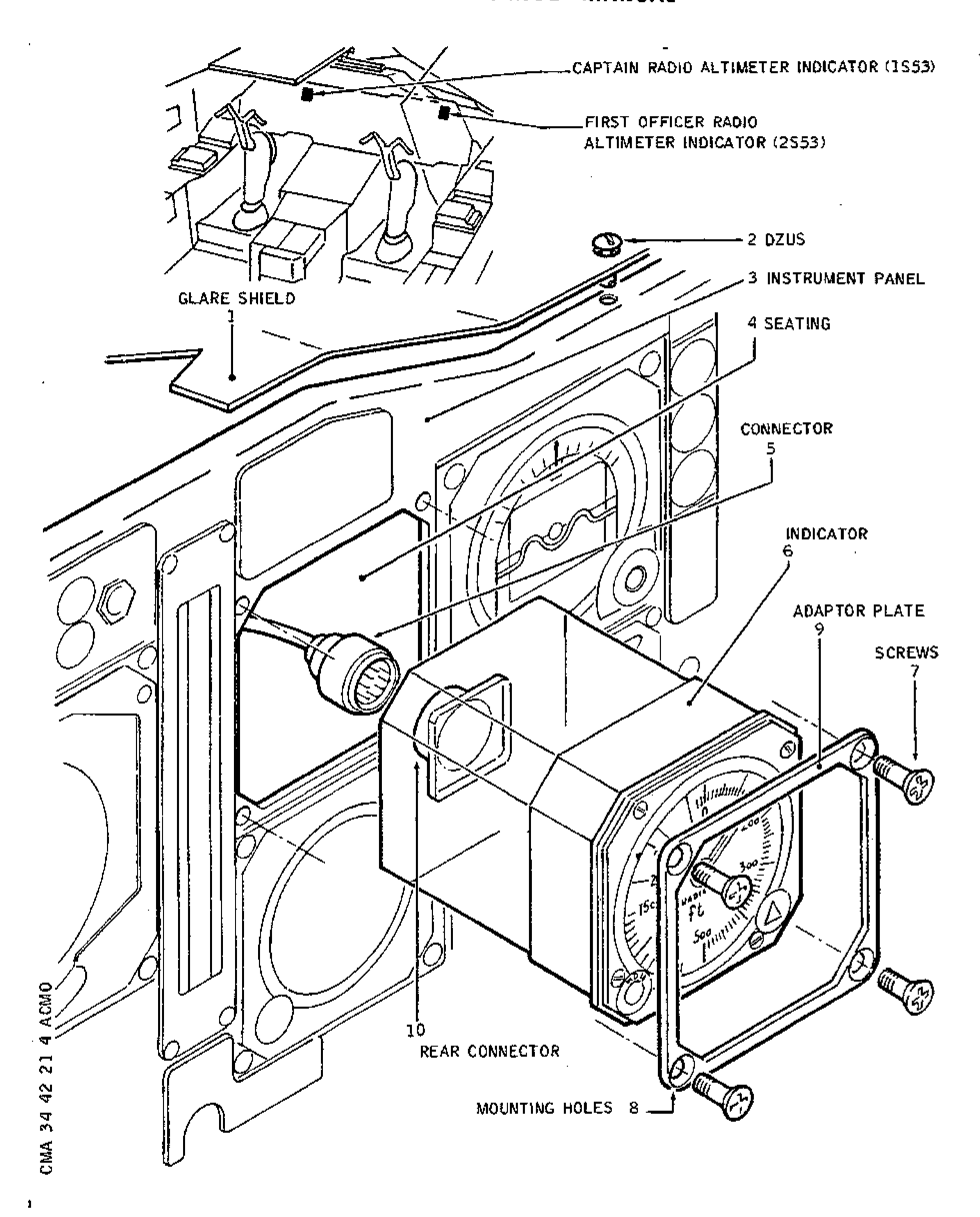
(1) Remove blanking caps from connectors (5) and (10).

(2) Position indicator (6) facing its seating (4), engage in seating and push fully against instrument panel (3).

(3) Position adaptor plate (9) and install and tighten the four mounting screws (7) in adaptor plate holes (8).

(4) Lift glareshield panel (1) partially, then gain access under glareshield panel and connect aircraft connector (5) to rear connector (10) on indicator (6).

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Removal/Installation of a Radio Altimeter Indicator
Figure 401

(5) Lower glareshield panel (1) and attach with dzus fasteners (2).

F. Close-Up

(1) Carry out a test of radio altimeter indicator (Ref. 34-42-21, Adjustment/Test).

RADIO ALTIMETER INDICATOR ADJUSTMENT/TEST

1. General

This test of Captain or First Officer radio altimeter indicator shall be carried out following removal/installation or replacement of an indicator.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Remove safety clips and tags and set the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD ALT1 SUP	2-213	1S 56	D 8
FLT CONT & NAV BUS 14XS		X355	H 2
LH DASH INST LTS SUP	13-215	L372	A12
RH DASH INST LTS SUP	13-216	L371	E 9
RAD ALT2 SUP		2S 56	F19
NAV INST BUS 13XS		X345	G 4

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) On panels 12-211 and 5-212, adjust LH and RH DASH INSTRUMENTS potentiometers and check that indicator lighting varies.

C. Test

(1) Make certain that the following circuit breakers are

reset :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
ATT/INST 1ST PLT SW SUP		1F 13	G16
AUDIO WARN SYS SUP 1		W 371	M21
ADI 1ST PLT INS 1 SUP & IND	2-213	1F 15	B 7
AUDIO WARN SYS SUP2	5-213	W 372	C17
RAD ALT 1 & 2 IND	15-215	S 57	C 5
ADI 2ND PLT INS2 SUP & IND	13-216	2F 15	Z13
NAV/INS 2ND PLT SW SUP	15=216	2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21

(2) On Captain (First Officer) radio altimeter, press and hold TEST push-button.

(a) On radio altimeter in operation check that
- warning flag appears.
- pointer indicates 100ft altitude.

(b) Aural warning sounds in audio warning system loud-speakers.

(c) On Captain and First Officer ADI'S, DH warning lights go off.

(d) On Captain (First Officer) ADI
- runway symbol disappears
- ALT flag is visible

(3) On Captain (First Officer) radio altimeter indicator, press and hold test push-button and adjust triangle marked knob for a decision height of 120ft.

(a) Aural warning ceases in audio warning system loud-peakers.

(b) On Captain and First Officer ADI'S, DH warning lights come on.

(4) Release test push-button on Captain (First Officer) radio altimeter indicator and set decision height to 0ft.

D. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(3) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

RADIO ALTIMETER ANTENNA - REMOVAL/INSTALLATION

1. General

Removal for replacement or check. Radio altimeter No. 1 system consists of transmission (1S54) and reception (1S55) antennas installed in zone 191 between frames 38 and 40. Radio-altimeter No. 2 system consists of transmission (2S54) and reception (2S55) antennas installed in zone 192 between frames 38 and 40. The four antennas are identical and mounted similarly and removal/installation of one antenna only will be described.

2. Radio-Altimeter Antenna

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
R Access Platform, 3.141 m (10 ft. 3 in.)	

B. Prepare

(1) Make certain on Captain (2-211) and First Officer (2-212) instrument panels that on radio altimeter indicators (1S53) and (2S53), button marked with a triangle is at counterclockwise stop.

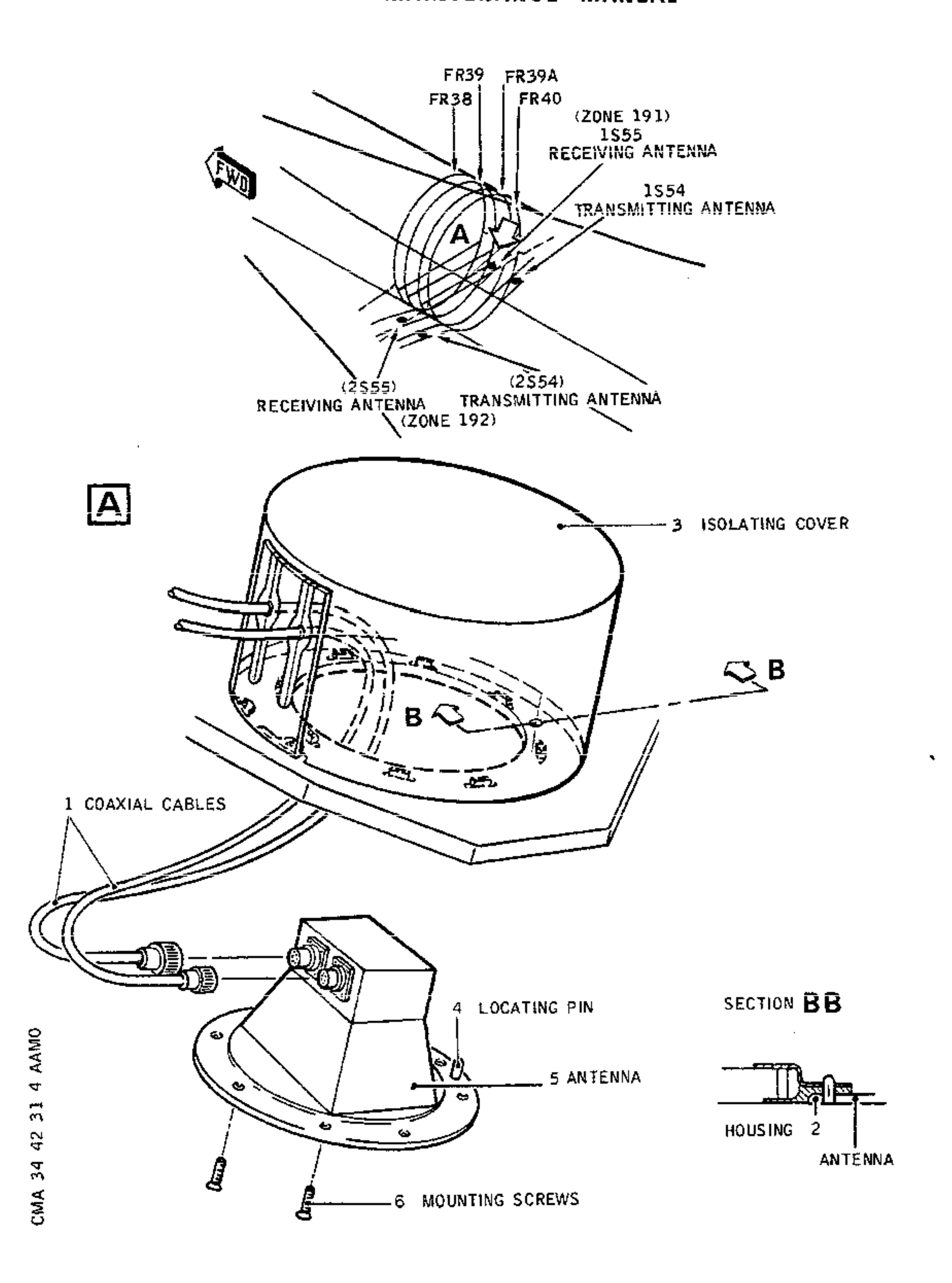
(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD ALT 1 SUP	2-213	1S 56	D 8
RAD ALT 1 & 2 IND	15-216	S 57	C 5
RAD ALT 2 SUP	13-216	2S 56	F19

(3) Position access platform in zone 191 or 192 beneath radio altimeter antenna to be removed.

C. Remove (Ref. Fig. 401)

R (1) Remove the eight mounting screws (6), while manually



R

Radio Altimeter Antenna - Removal/Installation
Figure 401

R supporting antenna (5).

(2) Remove antenna from housing (2) and disconnect the
R two aircraft coaxial cables (1) from antenna connectors.

(3) On fillet, clean antenna mounting area.

R (4) Check condition of aircraft coaxial connectors and of
R isolating cover (3).

R D. Preparation of Replacement Component

(1) Make certain of good external condition of antenna and particularly that connectors have no trace of corrosion.

E. Install
(Ref. Fig. 401)

R (1) Position antenna (5) near its housing (2) and connect
R the two coaxial cables (1) to appropriate connectors.

R (2) Install antenna, locating pin (4) facing its housing on
R the mounting base.

R (3) Supporting antenna in position, install and tighten the
R eight mounting screws (6).

F. Tests

(1) Remove safety clips and tags and reset the circuit breakers previously tripped in paragraph 2.B.(2).

(2) Carry out an operational test on the assembly concerned (Ref. 34-42-00, Adjustment/Test).

G. Close-Up

(1) Remove access platform from working area.

RADIO ALTIMETER TRANSCEIVERS - REMOVAL/INSTALLATION

1. General

Two radio altimeter transceivers are located in the lower baggage compartment. Transceiver 1S51 is located in zone 131, transceiver 2S51 in zone 132.

2. Radio Altimeter Transceivers

NOTE : As both transceivers are identically installed, only one removal/installation procedure is described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps for Electrical Connectors	
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
GRND POWER SERVICES SUP	25-216	X 368	B 5
GRND POWER LTS SUP		X 369	B 9
FWD BAGGAGE LTS SUP		L 763	C 2
FWD BAGGAGE DOOR FLOOR LT SUP		L 762	C 3

(3) On Captain's (2-211) and First Officer's (2-212) instrument panel, make certain that the triangle marked knob is at counterclockwise stop.

(4) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD ALT 1 SUP	2-213	1S 56	D 8
RAD ALT 1 & 2 IND	15-215	S 57	C 5
RAD ALT 2 SUP	13-216	2S 56	F19

(5) Open door 811 to gain access to lower baggage compartment.

(6) In lower baggage compartment, on LH panel, place light control switch in ON position.

C. Remove

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.D.

(2) Refer to 34-00-00, Servicing, paragraph 2.D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.F.

F. Test

(1) Remove safety clips and tags and reset the circuit breakers tripped in paragraph 2.B.(4).

(2) Carry out an operational test of the relevant radio altimeter system (Ref. 34-42-00, Adjustment/Test).

G. Close-Up

(1) In lower baggage compartment, on LH panel, place light control switch in OFF position.

(2) Close lower baggage compartment door 811.

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS) -DESCRIPTION AND OPERATION

RB 1. TCAS System Description

A. General (Ref. Fig. 001)

The TCAS (Traffic Alert and Collision Avoidance System) is a system whose function is to detect and display aircraft in the immediate vicinity and to provide the flight crew with indications to avoid these intruders by changing the flight path in the vertical plane only.

RB The TCAS Transmitter/Computer periodically interrogates intruder aircraft transponders, computes their trajectories and constantly determines their potential threat. Their acquisition is achieved by means of two transmit/receive antennas, one located on the underside of the fuselage and the other on the top.

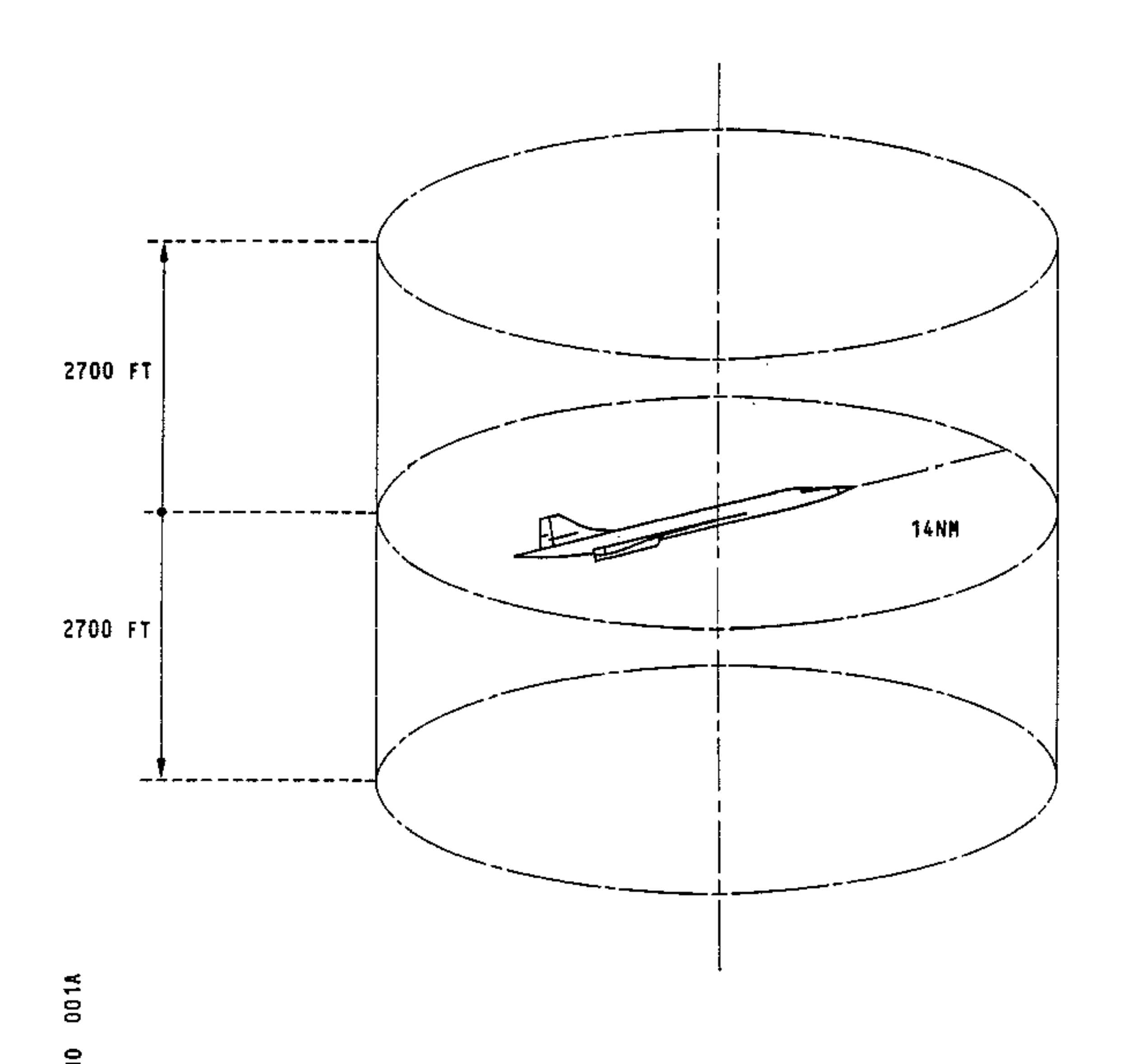
The system can establish individualized communications with each aircraft through ATC/Mode S transponders, thus permitting operation in dense traffic areas while avoiding
RB an overload of transmissions that would result from a general all intruder response.

RB TCAS is designed to provide the air traffic control system
RB with an additional monitoring possibility. The system
RB operates independently between aircraft but may be controlled from ground stations.

TCAS has the capability to communicate with ATCRBS (Air Traffic Control Radar Beacon System) ground stations equipped with the mode S system to indicate to them the vertical manoeuvre orders presented to the aircraft pilot. This information can facilitate the task of the ground station controller who, in turn, can modify the TCAS operating mode and cancel the avoidance orders if he deems it necessary for safety.

The surveillance envelope covers an area of ± 2700 feet in altitude and 14 NM minimum in range, but, on Concorde,
RB the display is 4 NM, 8 NM and 16 NM in 3 range selections.

The system maintains surveillance within a sphere determined by the transmit power and receiver sensitivity of the TCAS transceiver. The area in which a threat is imminent depends on the speed and path of the own A/C and the threat A/C. There is an area defined as TAU within the surveillance arc which represents the minimum time the flight crew need to discern a collision threat and take evasive action.



34 43 00 001A

TCAS - Surveillance Envelope
Figure 001

B. Principle (Ref. Fig. 002)

When an aircraft is airborne, its TCAS will periodically transmit interrogation signals for all ATCRBS and Mode S transponder-equipped aircraft in the vicinity. These signals are received by ATCRBS ground stations and by transponders of other aircraft.

In response to these interrogations, the transponders of
RB nearby mode C and S equipped aircraft return their altitude
RB value within their return transmissions. The TCAS computes the range between the two aircraft by measuring the elapsed time between transmission of the interrogation and reception of the reply.

The altitude, altitude rate, range and range rate are determined by periodic tracking of these exchanges and the data is used for intruder threat assessment.

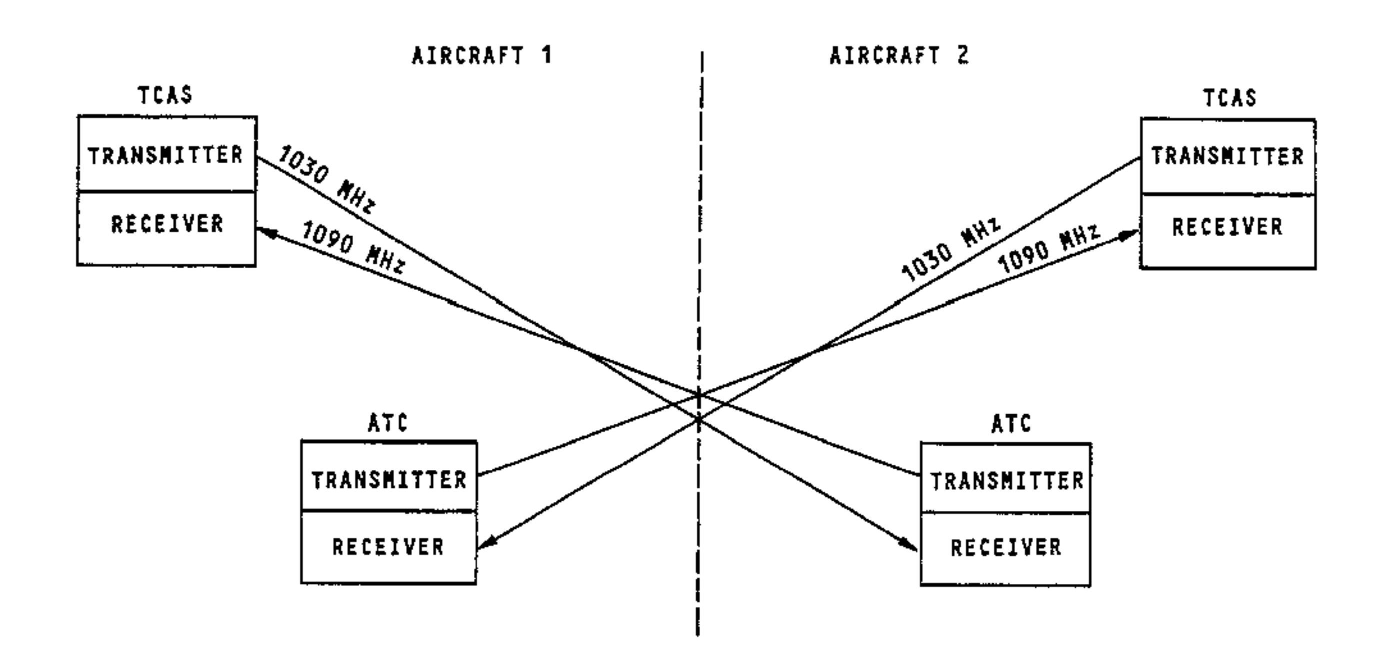
Each threat is treated individually but the TCAS determines the best collision avoidance possibility with respect to all aircraft in its vicinity, while establishing manoeuvre coordination with other TCAS-equipped aircraft. The optimum manoeuvre is the one that ensures an adequate separation of trajectories with a minimum vertical trend variation.

C. Advisories

Visual and aural advisories are supplied by the TCAS computer whenever assessment of the relative position of two aircraft reveals a potential collision hazard.

The Traffic Advisories indicate the position of nearby aircraft which are or may become a threat. Their display on the indicator alerts the flight crew to the presence of intruders and facilitates their visual acquisition.

The Resolution Advisories may be divided into two categories :
- Corrective Advisories that instruct the pilot to deviate from current vertical rate,
- Preventative Advisories that instruct the pilot to avoid certain manoeuvres.



34 43 00 002A

TCAS - Principle of Operation
Figure 002

(1) Aural Alerts

Traffic alerts, trajectory correction or holding visual orders are accompanied by synthesised voice announcements generated by the TCAS computer on the aircraft audio system. These messages and their meanings are described below:

- "CLIMB, CLIMB, CLIMB", climb at the rate shown by the green arc on the RA indicator.
- "CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB", as above except that it further indicates that own flight path will cross through that of the intruder.
- "REDUCE CLIMB, REDUCE CLIMB", reduce vertical speed to that shown by the green arc on the RA indicator.
- "INCREASE CLIMB, INCREASE CLIMB", follows A "CLIMB" advisory the vertical speed of the aircraft should be increased to that shown on the RA indicator.
- "CLIMB, CLIMB NOW, CLIMB, CLIMB NOW", follows a "DESCEND" advisory when a reversal in sense is required to achieve safe vertical separation from a manoeuvring intruder.
- "DESCEND, DESCEND, DESCEND", descend at the rate indicated by the green arc on the RA indicator.
- "DESCEND, CROSSING DESCEND, DESCEND, CROSSING DESCEND", as above except that it further indicates that own flight path will cross through that of the intruder.
- "REDUCE DESCENT, REDUCE DESCENT", reduce vertical speed to that shown by the green arc on the RA indicator
- "INCREASE DESCENT, INCREASE DESCENT", follows a "DESCEND" advisory. The vertical speed of the descent should be increased to that shown on the RA indicator.
- "DESCEND, DESCEND NOW, DESCEND, DESCEND NOW", follows a "CLIMB" advisory when a reversal in sense is required to achieve safe vertical separation from a manoeuvring intruder.

Two other aural advisories are also generated:

- "MONITOR VERTICAL SPEED, MONITOR VERTICAL SPEED", indicates that a forbidden vertical speed range exists (red arc) and that pilot must monitor vertical speed so as not to enter this range (Preventive Advisory).

This message is spoken only once if softening from a previous corrective advisory.

- "CLEAR OF CONFLICT", indicates that separation has been achieved and range has started to increase.

When an intruder's aircraft projected path brings it close enough to be of concern, "TRAFFIC TRAFFIC" alert is sounded.

(2) Advisories Inhibit Conditions

By selecting TA ONLY mode on the ATC/TCAS control unit, intruders of all types are displayed but will not be transformed into RA symbols and no vertical speed modification indications will be issued. The TA ONLY flag will be displayed on the VSI/TCAS indicator

In certain particular conditions, certain advisories are not generated as they could lead to the pilot adapting flight conditions that are hazardous or outside the aircraft's performance capabilities.

(a) Low Altitude Inhibition

a1) When a ground proximity alert occurs, the TCAS will be set to the TA-ONLY mode and all TCAS voice alerts are inhibited.

a2) All RA's and TA voice messages are inhibited when the aircraft radio altitude is less than 600 feet if the aircraft is ascending, and 400 feet if the aircraft is descending (TA/RA Mode change).

a3) No TCAS "INCREASE DESCENT" commands are given when the aircraft radio altitude is less than 1450 feet.

(a4) No TCAS "Descend" commands are given when the aircraft radio altitude is less than 1200 feet if the aircraft is ascending, and 1000 feet if the aircraft is descending.

(b) High altitude inhibition.

Above 60,000 feet, further climb orders are inapplicable as the aircraft performance capability does not permit them to be taken into account. "Climb" advisories are therefore inhibited above this altitude.

(c) Rejection of signals from aircraft on ground.

Aircraft on ground may reply to TCAS interrogations, producing an unnecessary overload in the processing and display of information. For this reason, the TCAS systematically eliminates response from aircraft at an altitude below 380 feet when its own altitude is itself below 1700 feet AGL.

But, as the altitude transmitted by the intruder is a barometric altitude with respect to sea level, the TCAS shall process this value to convert it into height above ground level in order to compare it with the 380 feet threshold.

The intruder's height above ground level can be deduced:

$$Zi/s = Zt/s - (Zt/m - Zi/m)$$

where
- Zi/s = height of the intruder above ground level.
- Zi/m = altitude of intruder above sea level.
- Zt/s = height of TCAS above ground level measured by radio altimeter.
- Zt/m = height of TCAS above sea level measured by ADC.

RB (d) Advisory inhibit discretes.

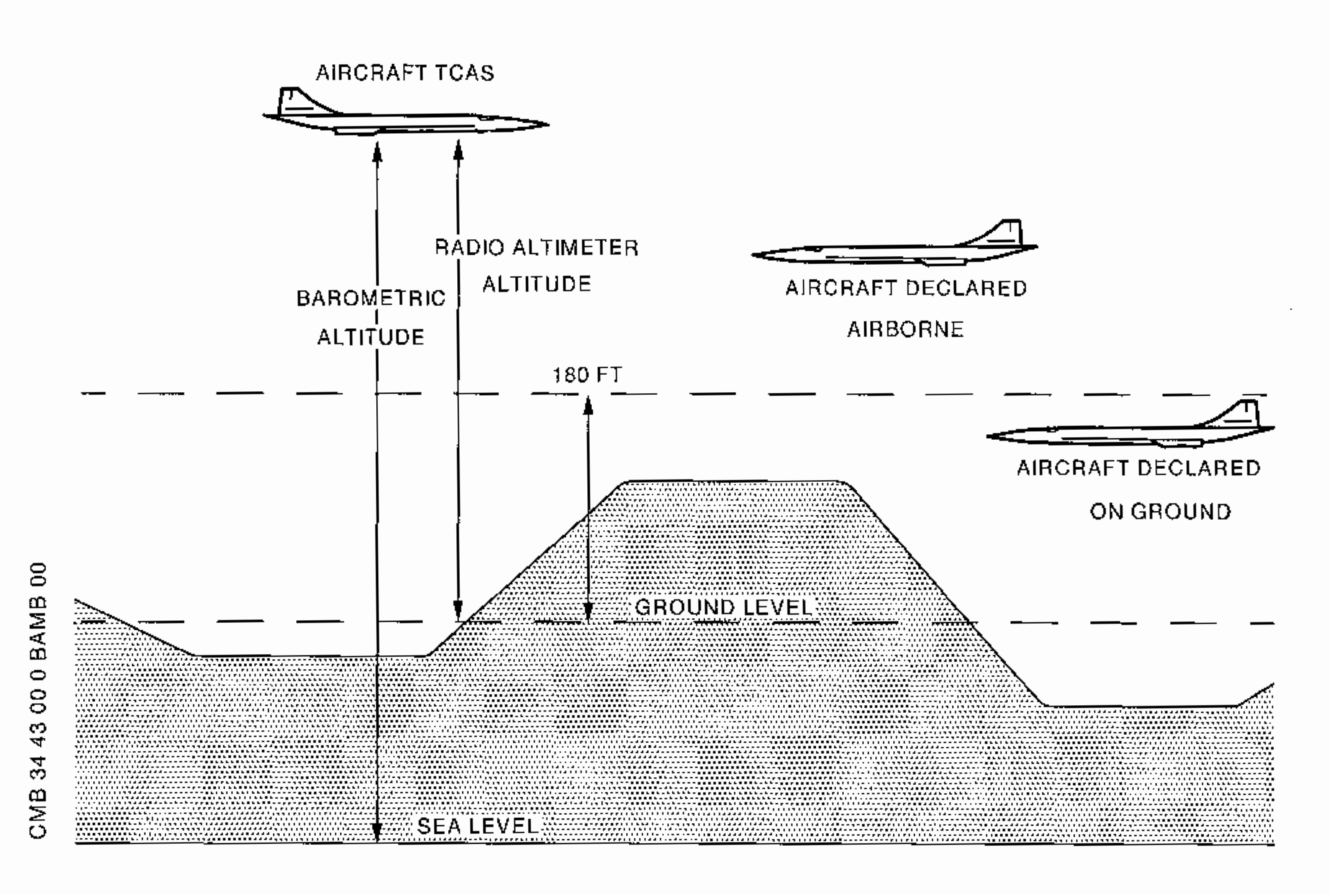
RB Three discretes are used to manage priority
RB between:

RB - stall,
RB - GPWC,
RB - and the TCAS computer.

RB The environmental alert priorities are: stall,
RB GPWC and then TCAS II. When TCAS II is
RB inhibited, the TA only mode is selected and
RB voice announcements are cancelled.

RB (e) Inhibition of RA's During Supersonic Flight.

RB During supersonic flight, RA's have to be
RB inhibited and TCAS computer goes into the TA ONLY
RB mode (Resolution advisories and all aural
RB messages are inhibited).



TCAS - Inhibition Condition
RB Figure 2A

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D. Display

The VSI/TCAS indicator is a colour liquid crystal display that permits display of conventional vertical speed information and, at the same time, intruder location and avoidance manoeuvre indications.

The indicator displays a traffic area around the aircraft symbol and appropriate avoidance orders on the vertical speed band, by means of green and red arcs indicating the permitted vertical speed to be adopted.

Intruders are represented by symbols positioned in range and relative bearing with respect to the aircraft symbol. A data tag and vertical trend arrow associated with each intruder symbol indicates the intruder's relative altitude and vertical trend.

E. Coordination

The avoidance manoeuvres initiated by the TCAS could create a conflict situation if directed at another TCAS-equipped aircraft as this aircraft may also take similar evasive action, resulting in an unchanged situation.

To avoid this situation, a communication link between the two aircraft is established via the transponders, exchanging coordination messages.

The first aircraft to detect the other one initiates the communication procedure, indicates the manoeuvre it intends to perform and communicates orders to the other aircraft requesting it to maintain its trajectory. This involves the use of Mode S transponders, the only equipment of this type possessing the LINK function required for data exchange.

The Mode S transponders provide the capability to transmit a unique address assigned to each aircraft, permitting them to reply individually to other TCAS-equipped aircraft. It can respond to ground station interrogations in Mode A, Mode C and Mode S if the stations are suitably equipped.

With respect to aircraft equipped with Mode A transponders only, the TCAS cannot generate resolution advisories as these transponders do not communicate aircraft altitude. The aircraft are however displayed on the VSI/TCAS indicator, enabling their location in range and bearing, but with no altitude indications.

The ground stations can modify the TCAS operating mode via the transponder link so as to inhibit resolution advisories in certain conditions.

CAUTION: INHIBITION OF RA'S DURING SUPERSONIC FLIGHT.

DURING SUPERSONIC FLIGHT, RA'S HAVE TO BE INHIBITED AND TCAS COMPUTER GOES INTO THE TA MODE ONLY (RESOLUTION ADVISORIES AND AURAL VOICE ARE INHIBITED).

2. System Components

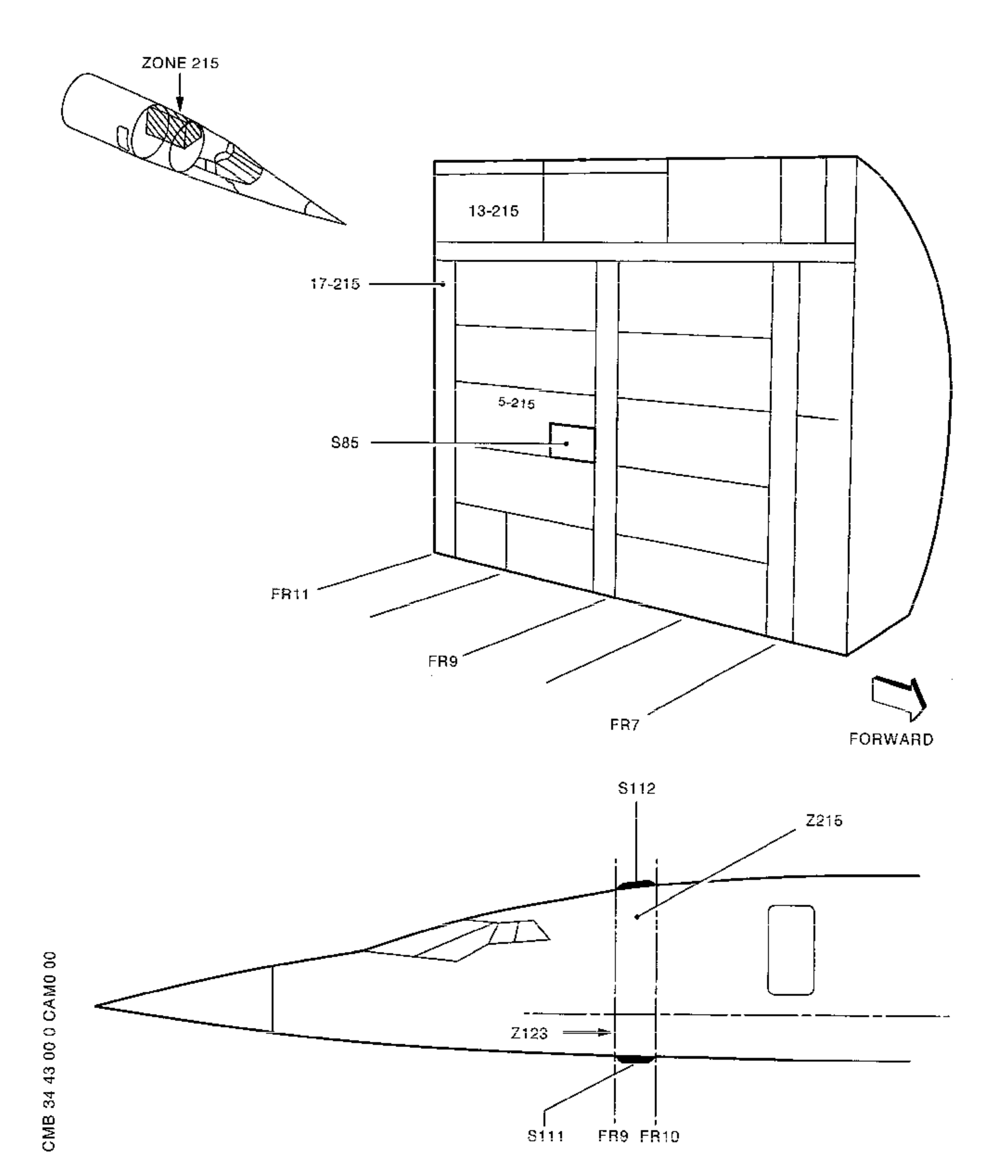
A. Components

The TCAS system consists of :

- One TCAS computer (S85)
- One top antenna (S112)
- One bottom antenna (S111)
- One ATC/TCAS control panel (S11)
- One TCAS circuit breaker (S86)
- One Pilot VSI/TCAS indicator (S87)
- One Co-pilot VSI/TCAS indicator (S88)
- One VSI/TCAS ADC amplifier (S94)
- One Audio mixing box (S89)

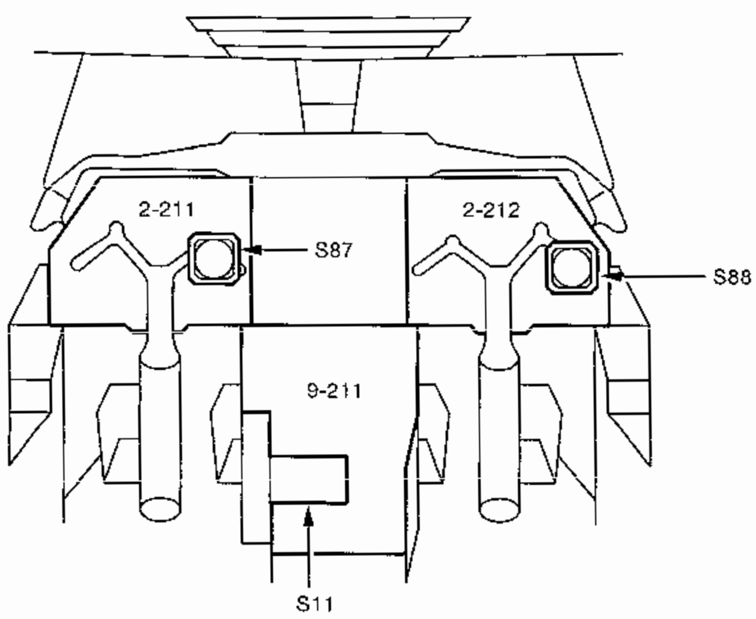
B. Component Location (Ref. Fig. 003)

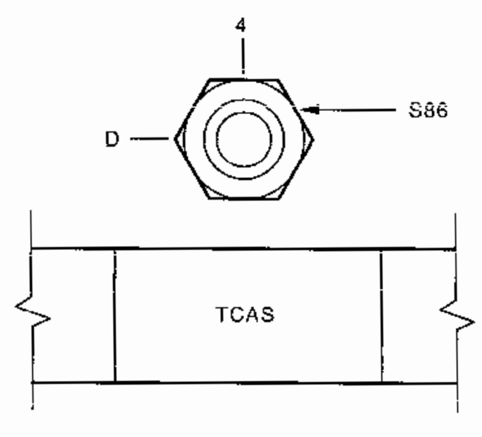
TITLE	FUNCTIONAL DESIGNATION	PANEL	ZONE
S85	COMPUTER - TCAS	5	215
S112	ANTENNA - TCAS, TOP	FR9, 10	215
S111	ANTENNA - TCAS, BOTTOM	FR9, 10	123
S11	CONTROL PANEL-ATC/TCAS	9	211
S86	C/B - TCAS	13	215
S87	INDICATOR - VSI/TCAS, PILOT	2	211
S95	C/B - VSI/TCAS, PILOT	13	215
S88	INDICATOR - VSI/TCAS, CO-PILOT	2	212
S96	C/B - VSI/TCAS, CO-PILOT	13	216
S94	AMPLIFIER - ADC, VSI/TCAS	17	215
S89	MIXING BOX - AUDIO	5	215



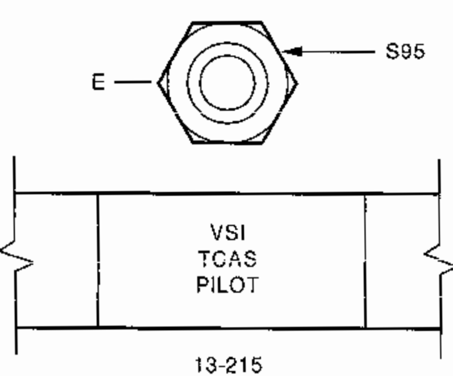
TCAS - Component Location S85, S111, S112
Figure 003

RB



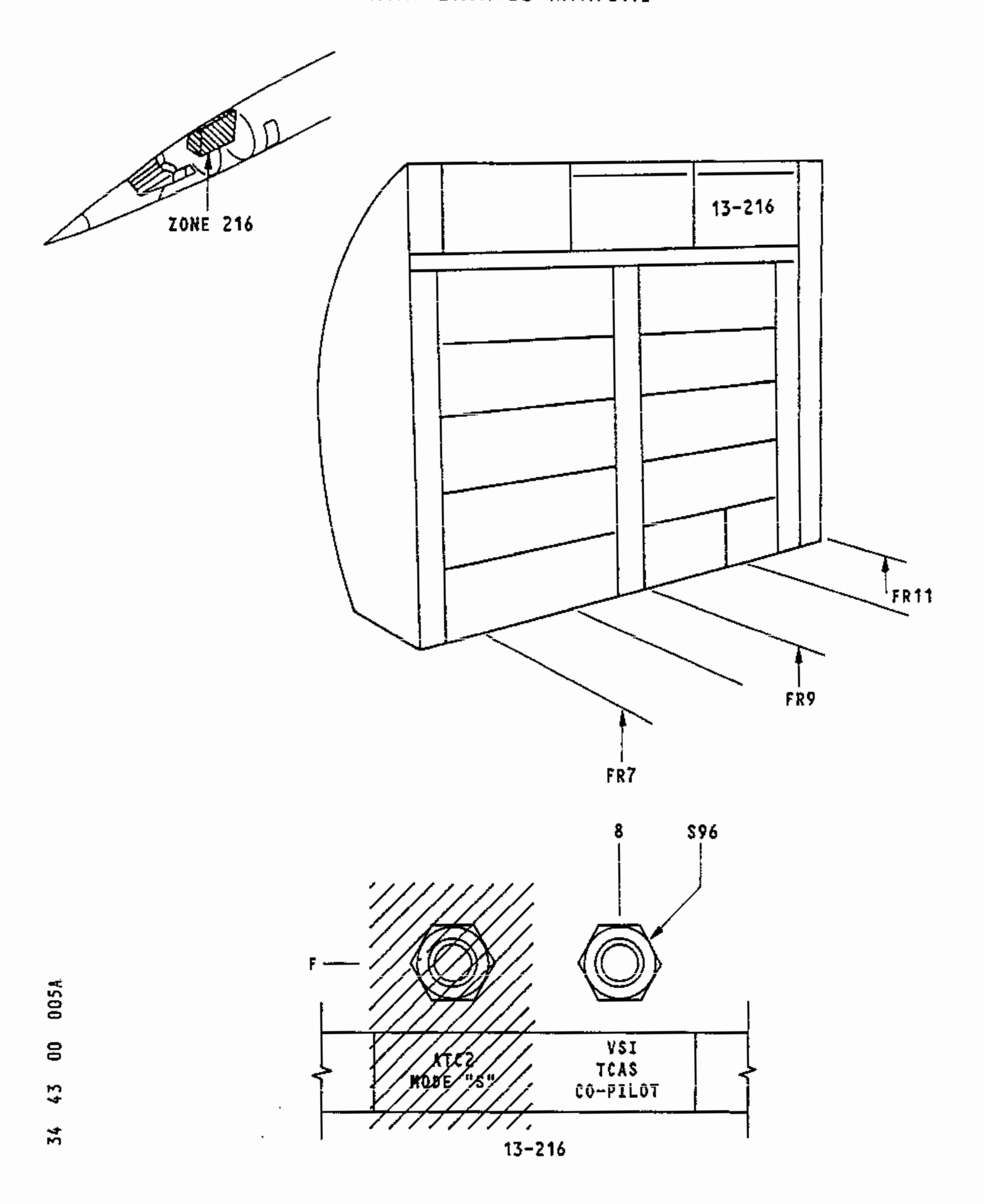


NOTE: FOR 13-215 PANEL SEE FIG.003

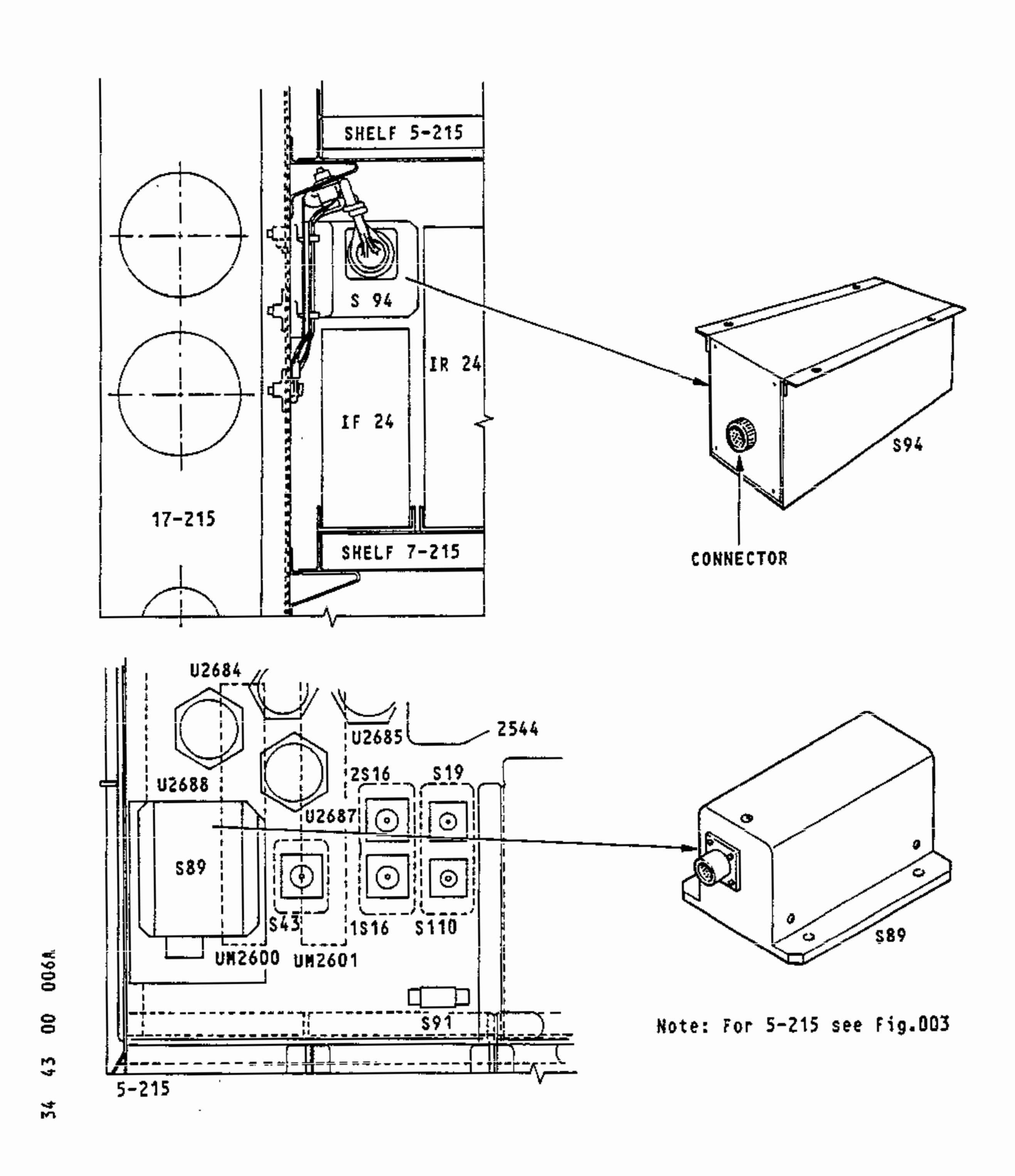


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R TCAS - Component Location S11, S86, S87, S88, S95, S86
Figure 004



TCAS - Component Location S96
Figure 005



TCAS - Component Location S94, S89
Figure 006

C. Associated Systems (Ref. Fig. 007)

SYSTEM	ATA
Stall warning	27-38
Landing gear and doors indicating	32-61
Audio warning	31-23
Flight environment data	34-10
Normal air data instrumentation	34-11
Light test and dimming	33-14
Compass coupler	34-21
Radio altimeter	34-42
Inertial navigation system	34-45
Ground proximity warning	34-47
Air traffic control	34-52

3. TCAS Computer

A. Description (Ref. Fig. 008)

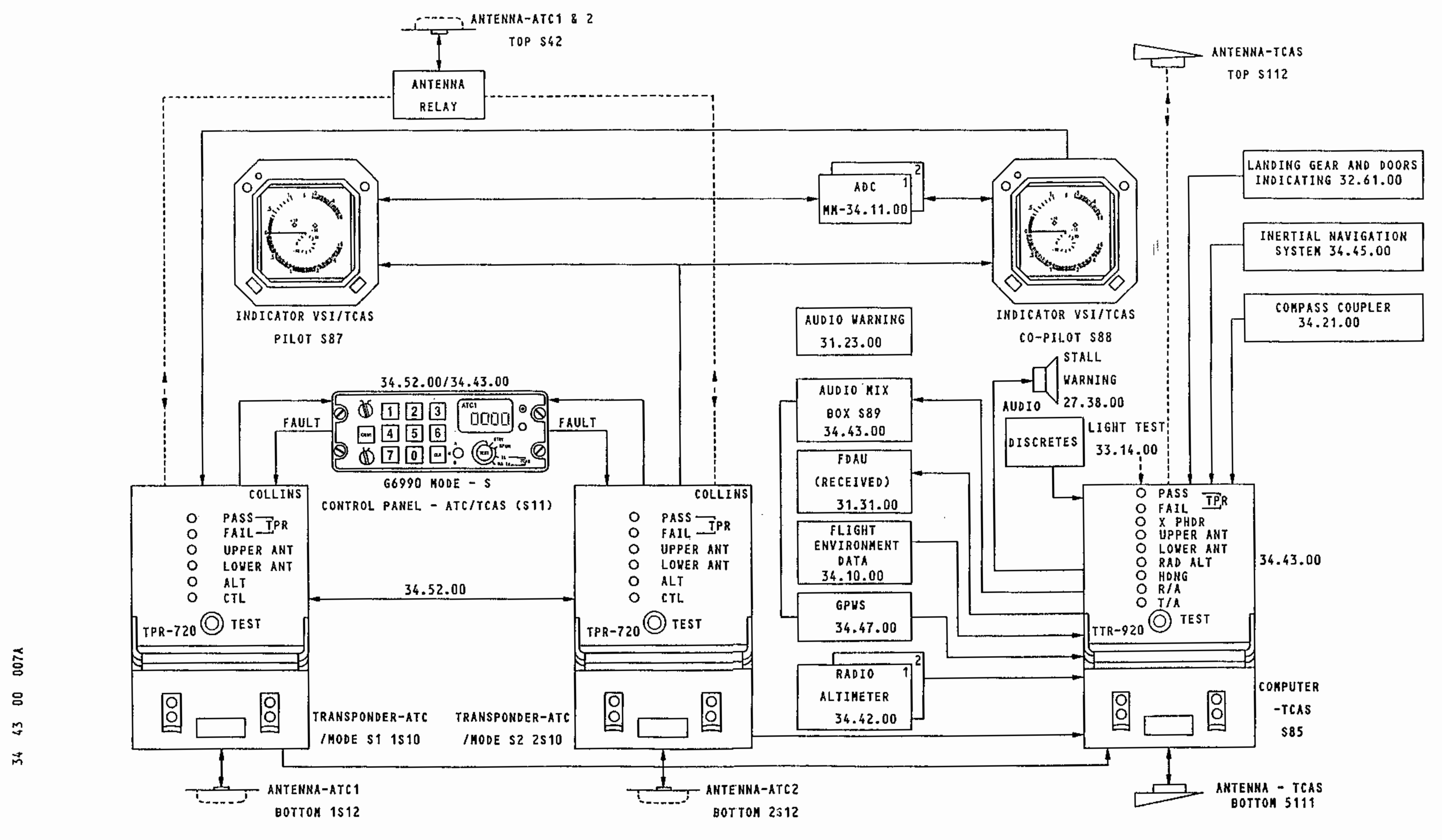
Size : 7.64 x 7.77 x 12.76 in (194 x 197.7 x 321.1 mm)

Weight : 18 lb (8.16 kg) max.

Electrical characteristics

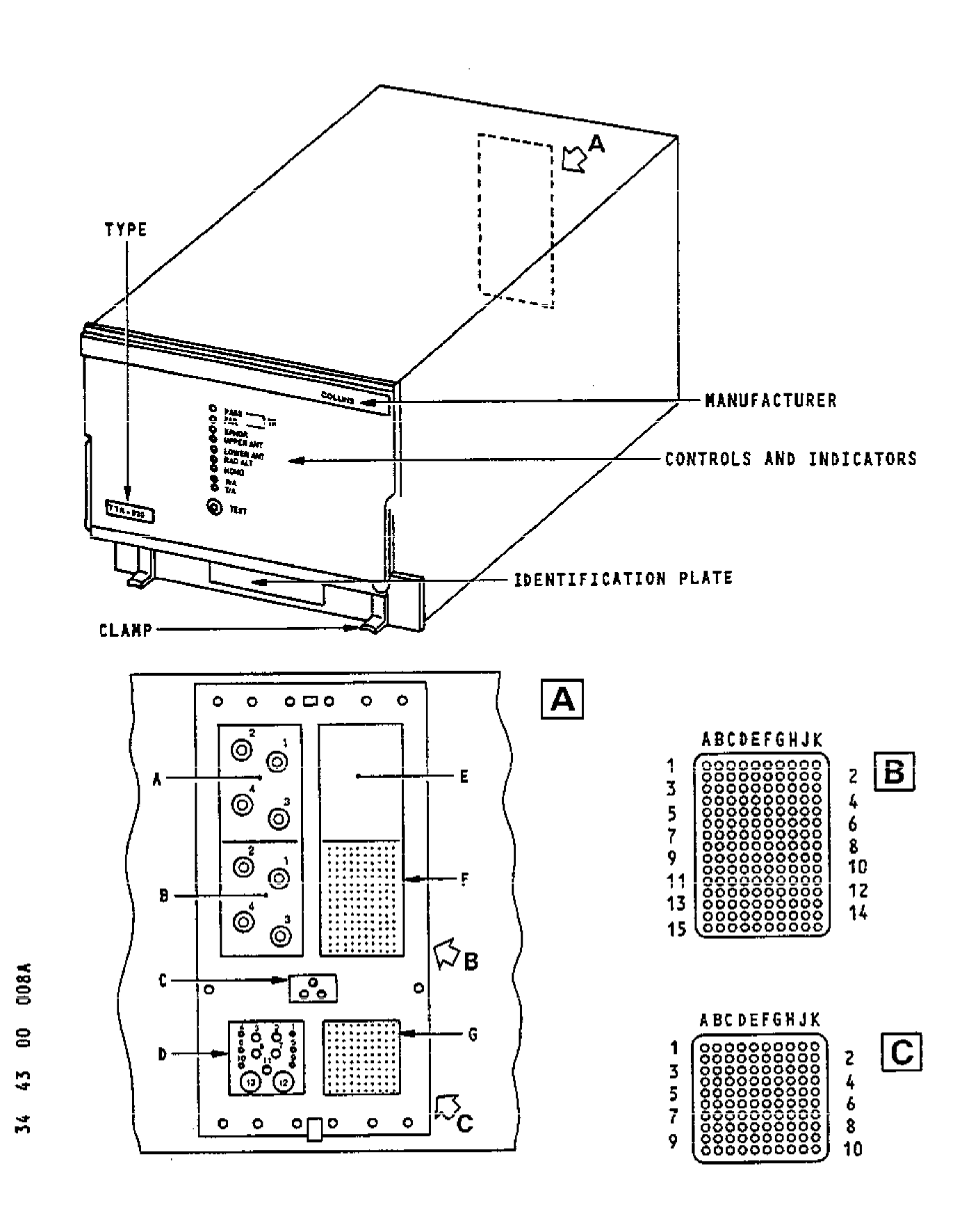
(1) Transmitter

- Transmit frequency : 1030 ± 0.01 MHz
- Transmitter rf output : 250 to 621 watts (56 ± 2 dBm)
- Sueveillance range : 14 NM



TCAS & ATC - Block Diagram - Interconnection
Figure 007

34 43 00 007A



TCAS - Front & Rear View - TTR 920
Figure 008

(2) Receiver

- Receiver frequency : 1090 ± 3 MHz
- Bandwidth : 9 MHz
- Sensitivity : -74 ± 2 dBm
- Advisory time : 20 to 25 seconds for resolution advisory (RA)
  40 to 45 seconds for traffic advisory (TA)
- Tracking capability : 30
- Whisper/shout attenuation : 26 dB
- Mode S data rate : 4 MHz ± 0.05%

(3) Power supply

= Primary power : 115 VAC, 400 Hz
- Nominal power : 80 W
- Power factor : COS ø 0.80

C. Presentation

(1) The front face includes (Ref. Fig. 008)

(a) A set of indicators with a TEST pushbutton switch whose functions are given in Table 001. These controls and indicators compose the TCAS computer self test.

(b) Two clamps that lock the TCAS computer on its support in zone 5-215 (Ref. Fig. 003).

(c) A TCAS computer identification plate.

(d) A plate giving the type of TCAS computer (TTR 920).

(e) A manufacturer's identification plate (COLLINS).

(2) The rear face includes (Ref. Fig. 008)

(a) Four coaxial connectors (A) for connection of the four coaxial connectors related to the top antenna.

(b) Four coaxial connectors (B) for connection of the four coaxial connectors related to the bottom antenna.

(c) Polarizing keys (C) that permit connection of only one type of equipment, depending on the direction of the three keys. This avoids installation errors with two items of the same size.

(d) An ITT CANNON 13-pin plug (D) whose main functions are:

- 115 V ac 400 Hz power supply
- Ventilation power supply
- 28 V dc power supply
- Grounds
- The two coaxial connectors serve for transponder pulse suppression. RB

(e) Spare (E)

(f) ITT CANNON 150-pin plug (F)

The main functions are :

- Alerts
- Synthesized voice
- Radio Altimeter 1 data
- Altitude pin programming
- Flight parameters
- ARINC 429, etc.

(g) ITT CANNON 100-pin plug (G)

The main functions are :

- RA (Guidance of data word 270 discrete output)
- Radio Altimeter 2 data
- Advisory inhibit discrete input
- CFDS (Central Fault Display System) data bus
- INCREASE CLIMB INHIBIT discrete
- Audio level pin programming, etc.

NOTE: For details of the different functions refer to the Vendor manual concerning the COLLINS TTR920 TCAS transmitter-receiver.

CONTROL OR INDICATOR	FUNCTION
TEST pushbutton switch	Permits initiating self-test of TTR-920. Test signals exercise operation of TTR-920.
TTR PASS indicator	Lights on completion of TTR-920 self-test to indicate TTR-920 has passed test.
TTR FAIL indicator	Lights on completion of TTR-920 self-test if TTR-920 has failed test.
XPDR indicator	Lights on completion of TTR-920 self-test if an associated transponder or data link interface has failed test.
UPPER ANT indicator	Lights on completion of TTR-920 self-test if upper TCAS antenna has failed test.
LOWER ANT indicator	Lights on completion of TTR-920 self-test if lower TCAS antenna has failed test.
RAD ALT indicator	Lights on completion of TTR-920 self-test if no radio altimeter information.
HDNG indicator	Lights on completion of TTR-920 self-test if no heading information.
R/A indicator	Lights on completion of TTR-920 self-test if resolution advisory indicator has failed.
T/A indicator	Lights on completion of TTR 920 self test if traffic advisory indicator has failed.

TCAS Computer Front Face - Self-Test Controls and Indicators
Table 001

D. Operation

(1) Principle

TCAS detects aircraft equipped with Mode S transponders by listening for Mode S squitter transmissions. Mode S transponders announce their presence by transmitting squitter messages once every second. (Ref. Fig. 009).

TCAS also detects A/C equipped with transponders that do not reply to Mode S interrogations but do reply to Mode C interrogations. TCAS must actively search for Mode C - equipped intruder aircraft because Mode C transponders do not transmit squitter messages.

Once the presence of a Mode C intruder is confirmed, it is tracked by the TCAS. Tracking is performed by repetitive TCAS interrogations in Mode S and Mode C format.

TCAS uses the Mode S function for certain identification of intruders as a 24-bit address is definitively assigned to each aircraft by air traffic control.

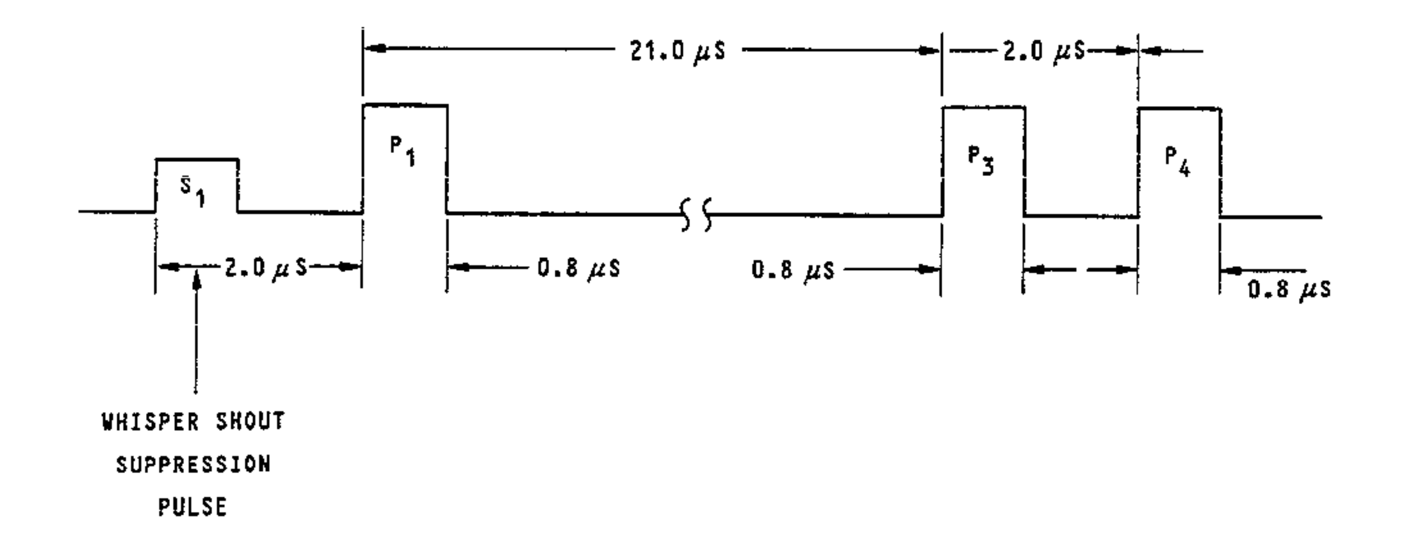
(a) Messages Configuration

The interrogation comprises of 3 pulses : P1, P2 and P6. P2 level is equal to or greater than the P1 level, which is the no-reply condition for aircraft equipped with Mode A or C transponders. Therefore, only Mode S transponders reply to the interrogation.

The useful information is contained in P6 divided into 56 or 112 chips. A chip is an unmodulated interval of 0.25 microseconds, preceded by possible phase reversals.

The message formats contain a number of bits permitting a more complete and diversified information exchange than in Mode C. There are two distinct message formats:

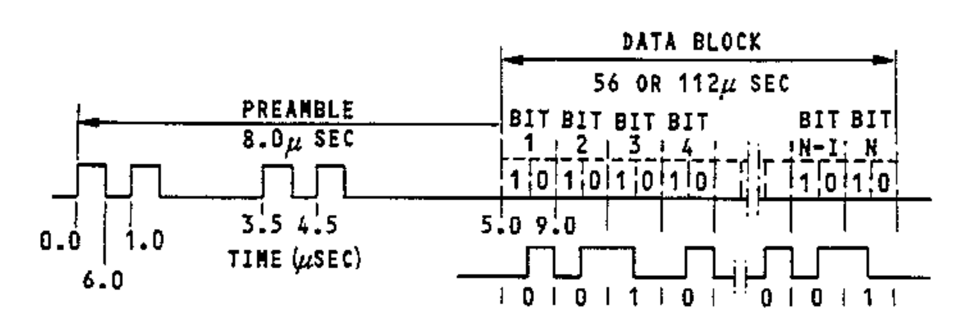
- all Mode S interrogations (Uplink format) are binary differential phase key shifting (DPKS) signals,
- Mode S replies (Downlink format) are formed by pulse position modulation (PPM) encoding the reply data. (Ref. Fig. 010).

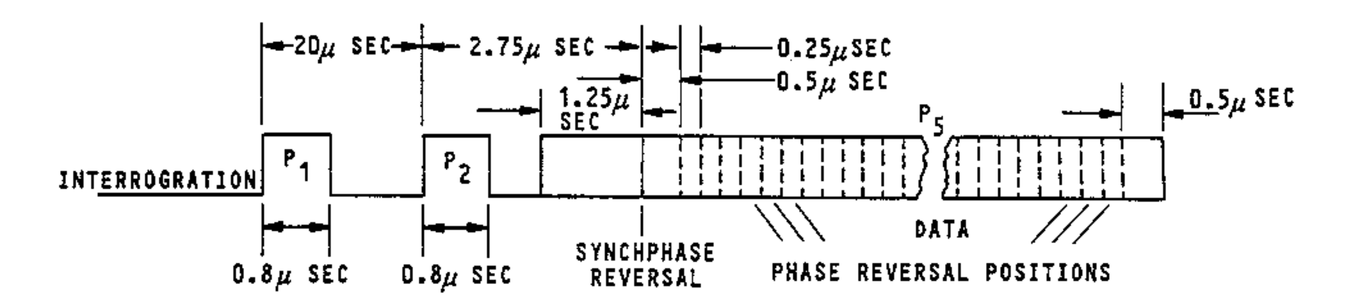


34 43 00 009A

TCAS - Mode S - General Call - (Squitters)
Figure 009

PRINTED IN ENGLAND





34 43 00 010A

TCAS - Mode S - Interrogation & Replies
Figure 010

(2) TCAS Computer - TTR 920 Collins (S85) (Ref. Fig. 011)

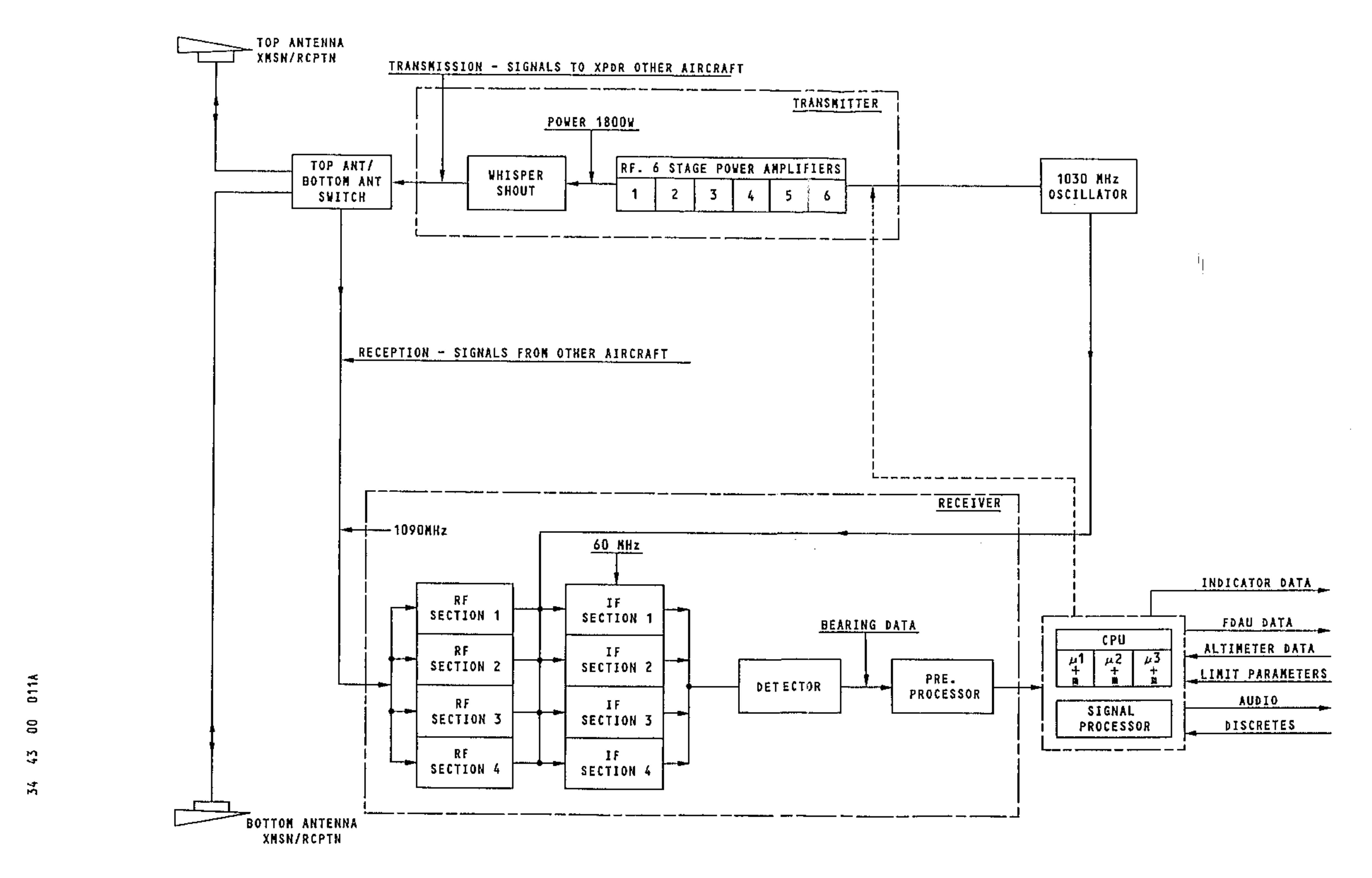
Contains circuits for receiving, transmitting, signal processing (including computing), and interfacing with other components of TCAS. A frequency source generates 1030 MHz for the transmitter output and receiver local oscillator. The receiver has four individual RF and IF sections, one for each of the four directional segments of the directional antenna. At the receiver detector, the signals are combined to allow received-signal bearing information to be determined. This information is passed to the signal processor.

The transmitter is a six-stage, solid-state circuit that develops 1800 watts. The RF output is applied to a whisper/shout attenuator that controls the transmitted power applied, through the diplexer, beam steering network and top/bottom antenna switch to the antenna. The beam steering network has a phase-shifter network which generates four outputs from the transmitter RF and controls their phase relationships. The outputs are connected to the four antenna elements through the top/bottom switch. The phase of the four output signals shapes and points the beams of radiated RF, or generates an omnidirectional pattern. The top/bottom switch connects the beam steering network output to either the top or bottom antenna. When an L-band omnidirectional antenna is used on the bottom of the aircraft, only one switch terminal is connected to the antenna. The other three terminals are unterminated.

A signal processor and CPU provide the control and data analysis necessary for the TCAS computer operation. The signal processor circuits serve as a preprocessor between the system software and the RF circuits. The CPU is made up of three microprocessors and their associated memories. This is the portion of the TTR-920 that contains the algorithms for analyzing data developed as a result of signals from transponders of other aircraft. The CPU generates the traffic and resolution advisories for output to the cockpit displays. It is software-controlled and communicates with the signal processor and input/output interface through the system bus.

The input/output interface circuits are the A/D, D/A, ARINC, discrete, and analog circuits required to communicate with external TCAS equipment. The interface has a CPU to control its operation.

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TCAS - Block Diagram
Figure 011

4. ATC/TCAS Control Panel (S11)

For the Description and Operation of the ATC/TCAS control panel refer to Chapter 34-52-00.

5. VSI/TCAS Indicator S87, S88

A. Description (Ref. Fig. 012)

(1) General

The VSI/TCAS indicator displays :

- Instantaneous vertical speed by means of a pointer and a circular scale.

- TCAS data :

  - Traffic information (TA mode) ; coloured symbols and tags displaying intruder positions and their manoeuvres.

  - Resolution orders (RA mode) ; corrective actions or restricted space to avoid collision. Red and green coloured arcs are superimposed against on the VSI vertical speed scale.

  - Fault messages and miscellaneous indications.

(2) Characteristics

The indicator is housed in a 3 ATI-S casing in accordance with ARINC standard 408A.

Weight	: < 1.5 kg (3.3 lb)
Power consumption	: < 15 watts nominal
	: < 20 watts with heater and full brightness control in cold warm up conditions.

(3) Functions displayed on the indicator

Three functions can be displayed on the indicator.

34 43 00 012A

TCAS - VSI/TCAS Indicator
Figure 012

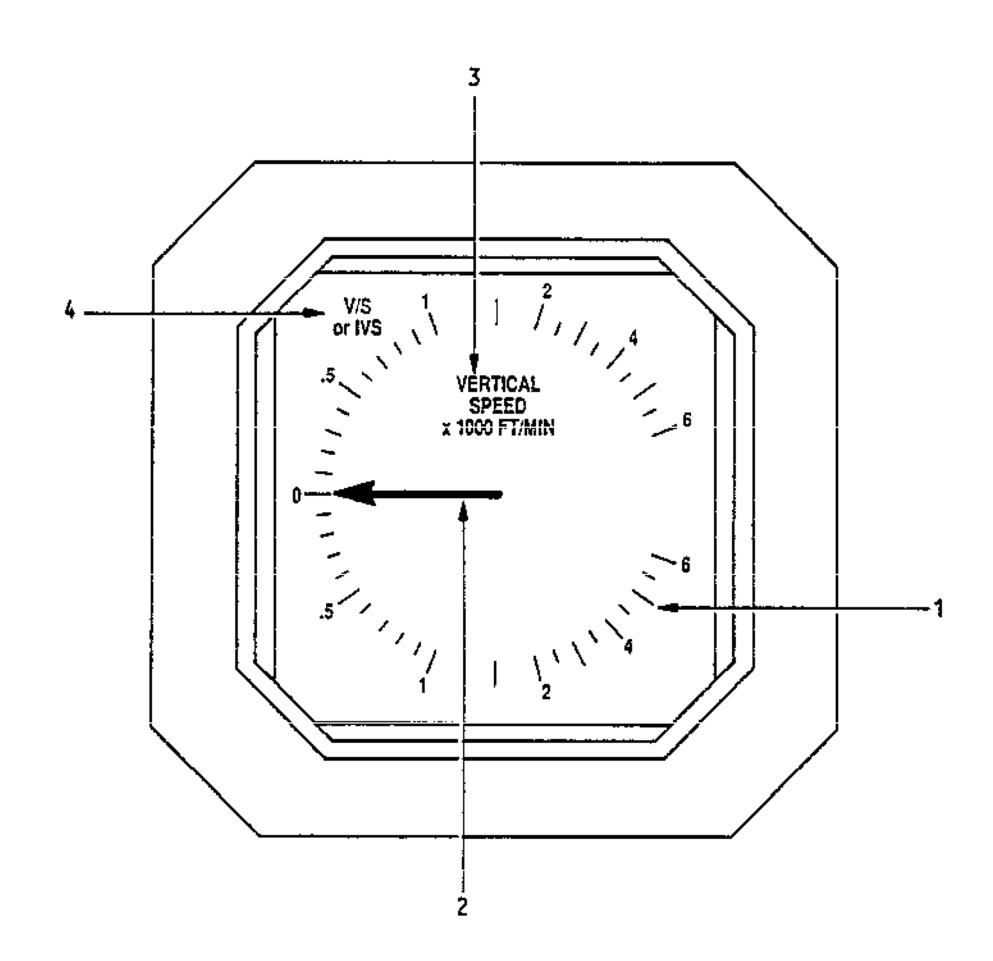
(a) A vertical speed function (VSI mode) (Ref. Fig. 013)

(b) A resolution advisory function (RA) (Ref. Fig. 014)

(c) A traffic advisory function (TA) (Ref. Fig. 015)

In the TA mode, two symbologies are used :

- fixed symbols
- symbols relative to intruder position with respect to the own aircraft symbol.

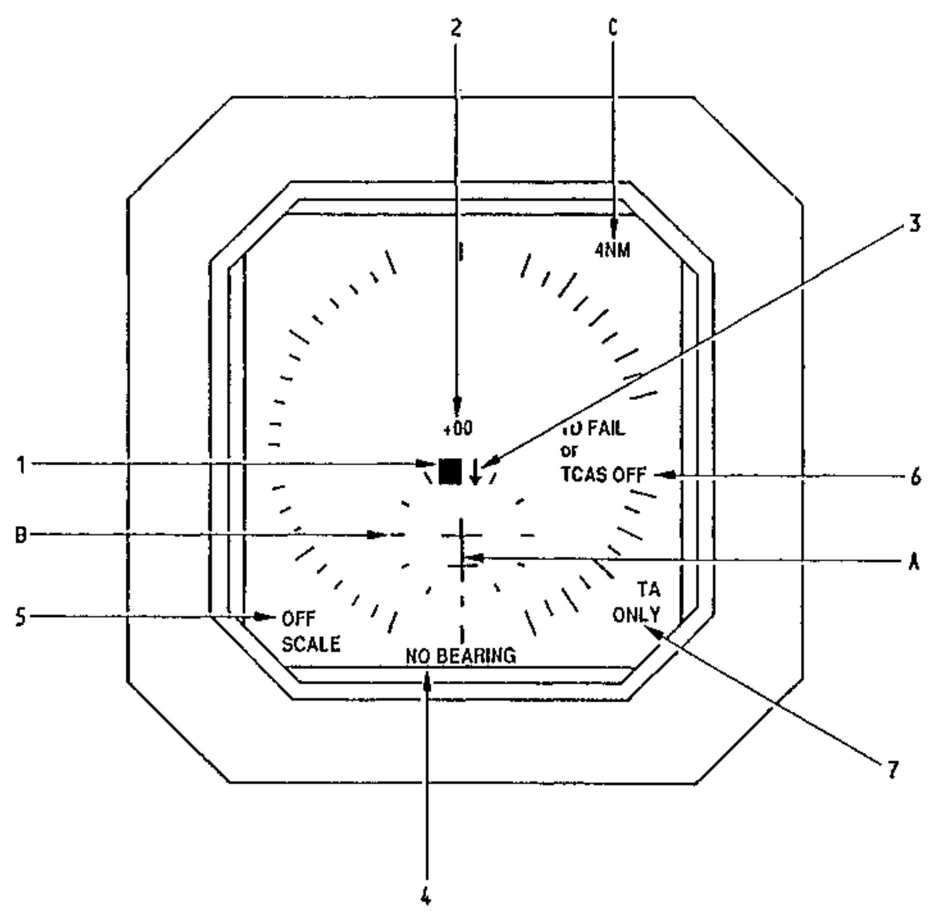


34 43 00 013A

VERTICAL SPEED FUNCTION

1. VERTICAL SPEED SCALE GRADUATED FROM + 6000 TO - 6000 FT/MIN.
2. VERTICAL SPEED POINTER.
3. VERTICAL SPEED LEGEND.
4. VERTICAL SPEED FAILURE WARNING FLAG V/S OR IVS OPERATING FLAG.

TCAS - VSI/TCAS Indicator (VSI Mode)
Figure 013



TRAFFIC FUNCTION (TA-RA/VSI MODE)

FIXED SYMBOLS
A. OWN AIRCRAFT SYMBOL. THE INTERSECTION OF THE VERTICAL LINE AND UPPER HORIZONTAL LINE GIVES THE REFERENCE POINT FOR THE DISTANCES DISPLAYED (4 NM AT THE FRONT AND 2.5 NM AT THE BACK FOR THE BASIC CONFIGURATION).
B. RANGE RING. THE CENTER OF EACH OF THE TWELVE CLOCKWISE MARKS IS LOCATED ON THE CIRCLE WITH A RADIUS OF 2 NM FOR THE BASIC CONFIGURATION.
C. SELECTED RANGE DISPLAY.

INTRUDER SYMBOLS
1. SYMBOL FOR DISPLAYING AN INTRUDER. ITS POSITION IN RELATION TO THE CENTER OF THE OWN AIRCRAFT SYMBOL GIVES ITS DISTANCE AND BEARING. FOUR SYMBOLS ARE USED TO IDENTIFY THE TYPE OF INTRUDER.

■ RESOLUTION ADVISORY (RA) SYMBOL (RED FILLED SQUARE).
● TRAFFIC ADVISORY (TA) SYMBOL (YELLOW FILLED CIRCLE).

◆ PROXIMATE TRAFFIC SYMBOL (CYAN FILLED DIAMOND).
◇ NO THREAT (OTHER) SYMBOL (CYAN DIAMOND OUTLINED).

2. TAG INDICATES ALTITUDE. THE DISPLAY IS AS FOLLOWS:
RELATIVE ALTITUDE - TWO DIGITS (+ ABOVE, - BELOW)
ACTUAL ALTITUDE - THREE DIGITS SAME ALTITUDE - TWO ZEROS.
THE UNIT IS HUNDREDS OF FEET.

3. VERTICAL DIRECTION ARROW INDICATES THE RELATIVE VERTICAL SPEED OF THE INTRUDER. THE DISPLAY IS AS FOLLOWS: NO VERTICAL RATE (NO ARROW), CLIMBING (ARROW POINTS UPWARDS), DESCENDING (ARROW POINTS DOWNWARDS).

4. "NO BEARING" INTRUDER. THE POSITIONING OF THE SYMBOL (TA AND RA SYMBOLS ONLY) IS NOT POSSIBLE BUT IS REPLACED BY A "NO BEARING" MESSAGE. EXAMPLE: TA 15.0 + 41.

5. OFF SCALE MESSAGE. THE RA OR TA INTRUDER IS OUTSIDE THE DISPLAY RANGE SCALE.

6. TD FAIL FLAG (FAILURE IN THE TRAFFIC FUNCTION ONLY) OR TCAS OFF MESSAGE (TCAS COMPUTER IS IN A SPECIAL OPERATING MODE).

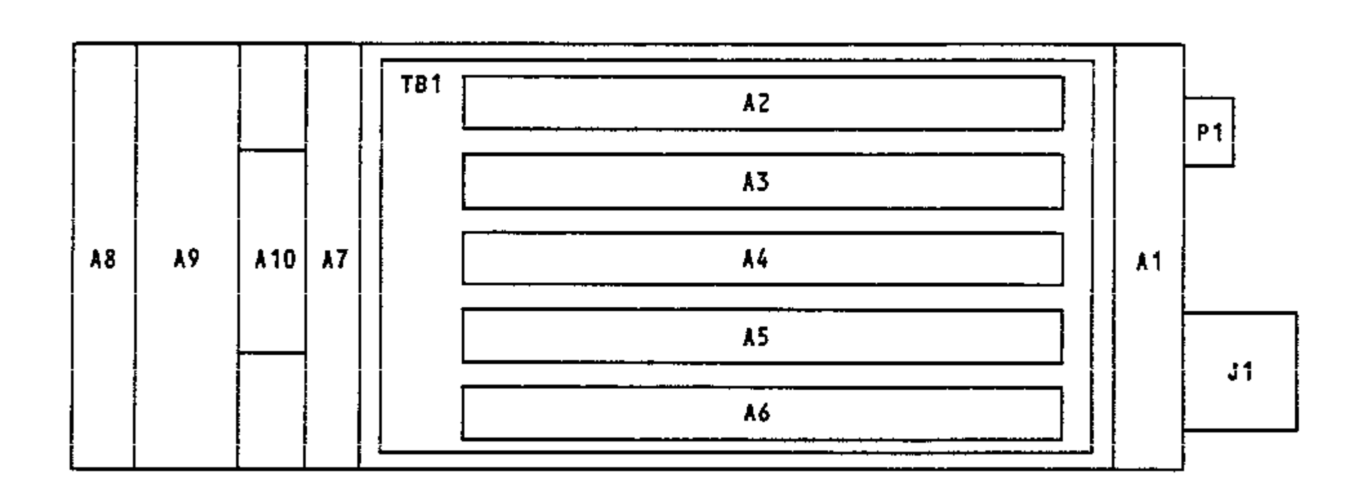
7. TA ONLY MESSAGE. THIS MESSAGE IS CONTINUOUSLY DISPLAYED IF THE TCAS COMPUTER IS IN A SPECIAL OPERATING MODE. THE MESSAGE IS DISPLAYED IN BLACK LETTERS ON A WHITE BACKGROUND IN NORMAL OPERATION AND A YELLOW BACKGROUND IN THE PRESENCE OF AT LEAST ONE TA.

34 43 00 015A

VSI/TCAS Indicator Traffic Function
(TA-RA/VSI Mode)
Figure 015

B. Operation

(1) Location of the different modules inside the indicator (Ref. Fig. 016)

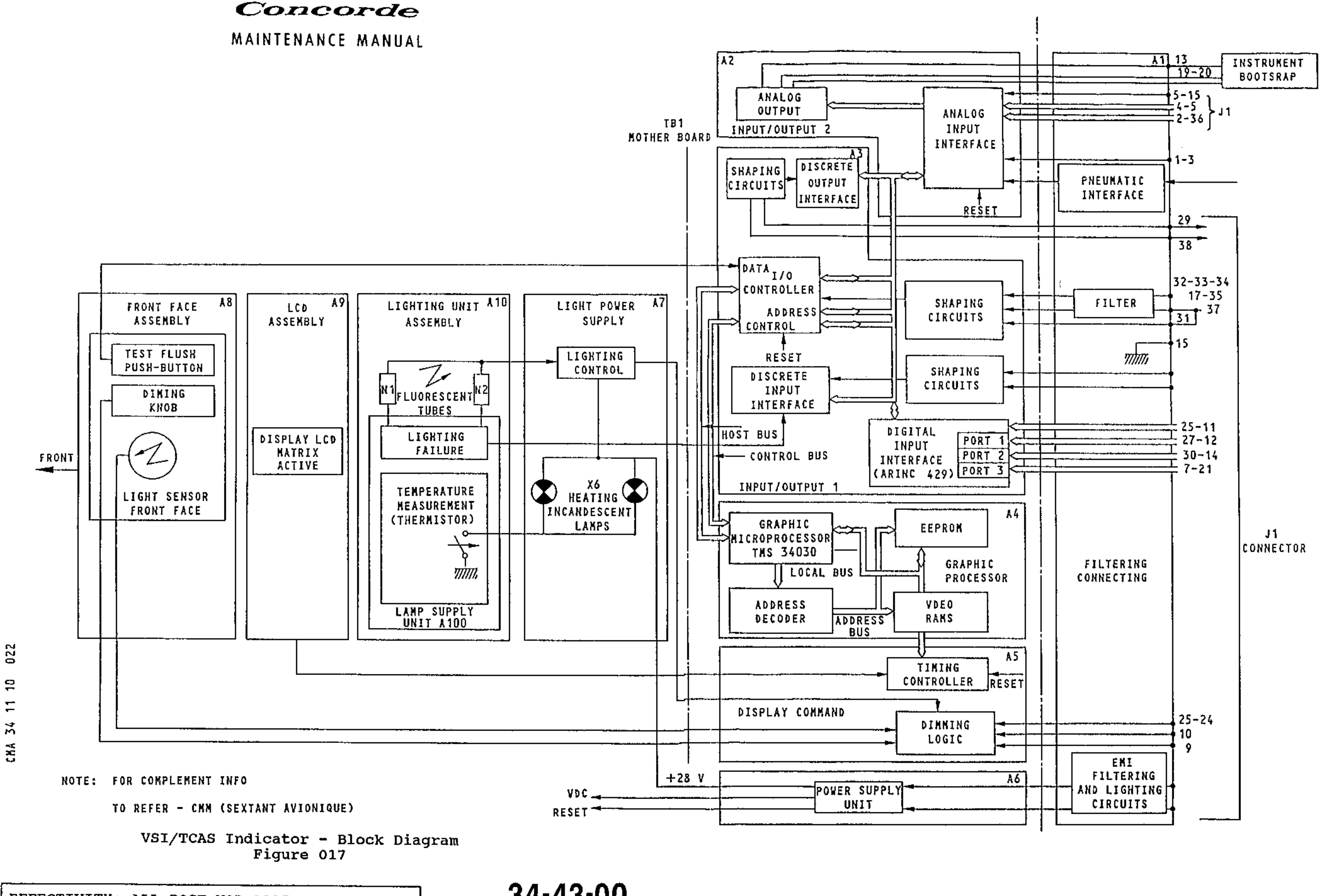


A8	FRONT FACE ASSEMBLY
A9	LCD ASSEMBLY
A10	LIGHTING UNIT ASSEMBLY
A7	LIGHTING POWER SUPPLY
TB1	MOTHER BOARD
	A2 INPUT/OUTPUT 2
	A3 INPUT/OUTPUT 1
	A4 GRAPHIC PROCESSOR
	A5 DISPLAY COMMAND
	A6 POWER SUPPLY UNIT
A1	FILTERING CONNECTING
J1	CONNECTOR
P1	PNEUMATIC PLUG

34 43 00 016A

VSI/TCAS Indicator
Figure 016

(2) Block diagram VSI/TCAS indicator (Ref. Fig. 017).



CMA 34 11 10 022

NOTE: FOR COMPLEMENT INFO

TO REFER - CMM (SEXTANT AVIONIQUE)

VSI/TCAS Indicator - Block Diagram
Figure 017

6. TCAS antennae (Ref. Fig. 018)

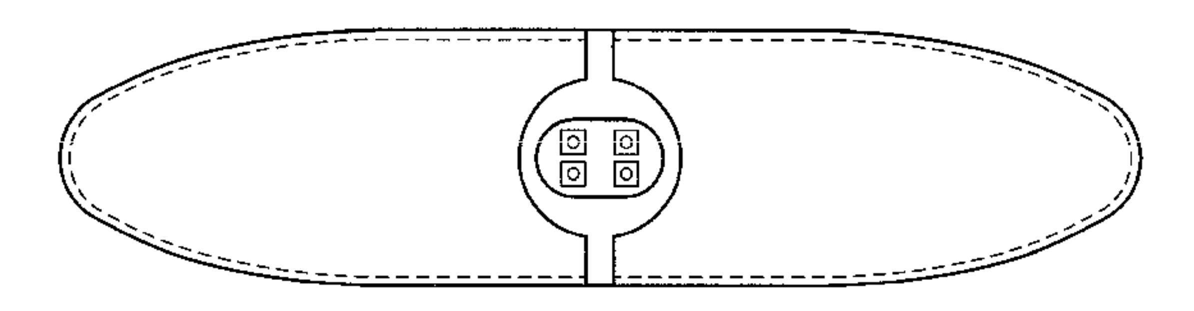
A. Description

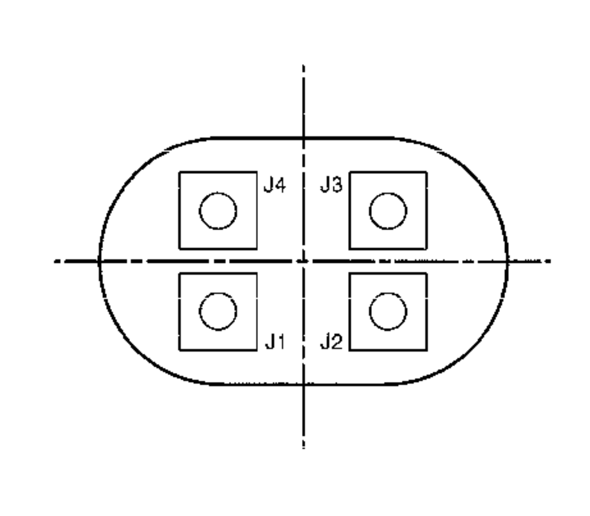
RB B. "Collins" TRE 920-C type profiled directional antenna, P/N 622-9922-101 (S111, S112).

The system includes one top and one bottom antenna.

CHARACTERISTICS	SPECIFICATION
Physical	
Overall dimensions (See Note)	Height without coaxial connectors 33.0 (1.30) Height with coaxial connectors 52.05 (2.055) Length with base 749.3 (29.50) Width with base 209.6 (8.25)
Weight	2.0 kg (4.40 lb)
Functional connectors	Coaxial type, TNC (Qty off 4)

NOTE : Dimensions are given in millimeters (inches).





COLOUR CODE CHART

	CONN	BAND	LETTER COLOUR
S111.1	J1	YELLOW	BLACK
S111.2	J2	BLACK	WHITE
S111.3	J3	BLUE	WHITE
S111.4	J4	RED	WHITE

FOR BOTTOM ANTENNA S111

NOTE: FOR TOP ANTENNA S112

S112.1	J1	COLOURS IDENTICAL TO S111
S112.2	J2	
S112.3	J3	
S112.4	J4	

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TCAS - Top or Bottom Antenna - General View
Figure 018

RB

7. VSI/TCAS ADC amplifier (S94)

A. Description

(1) General (Ref. Fig. 019)

The amplifier, common to the Pilot and Co-pilot systems:

RB (a) Adapts vertical speed (Vz) information to the
RB VSI/TCAS indicators installed with the Concorde
RB TCAS system. It is composed of two identical
RB and independent channels.

RB (b) Inhibits Resolution Advisories (RA) by
RB activating a switch at Mach 1 ± 0.01.

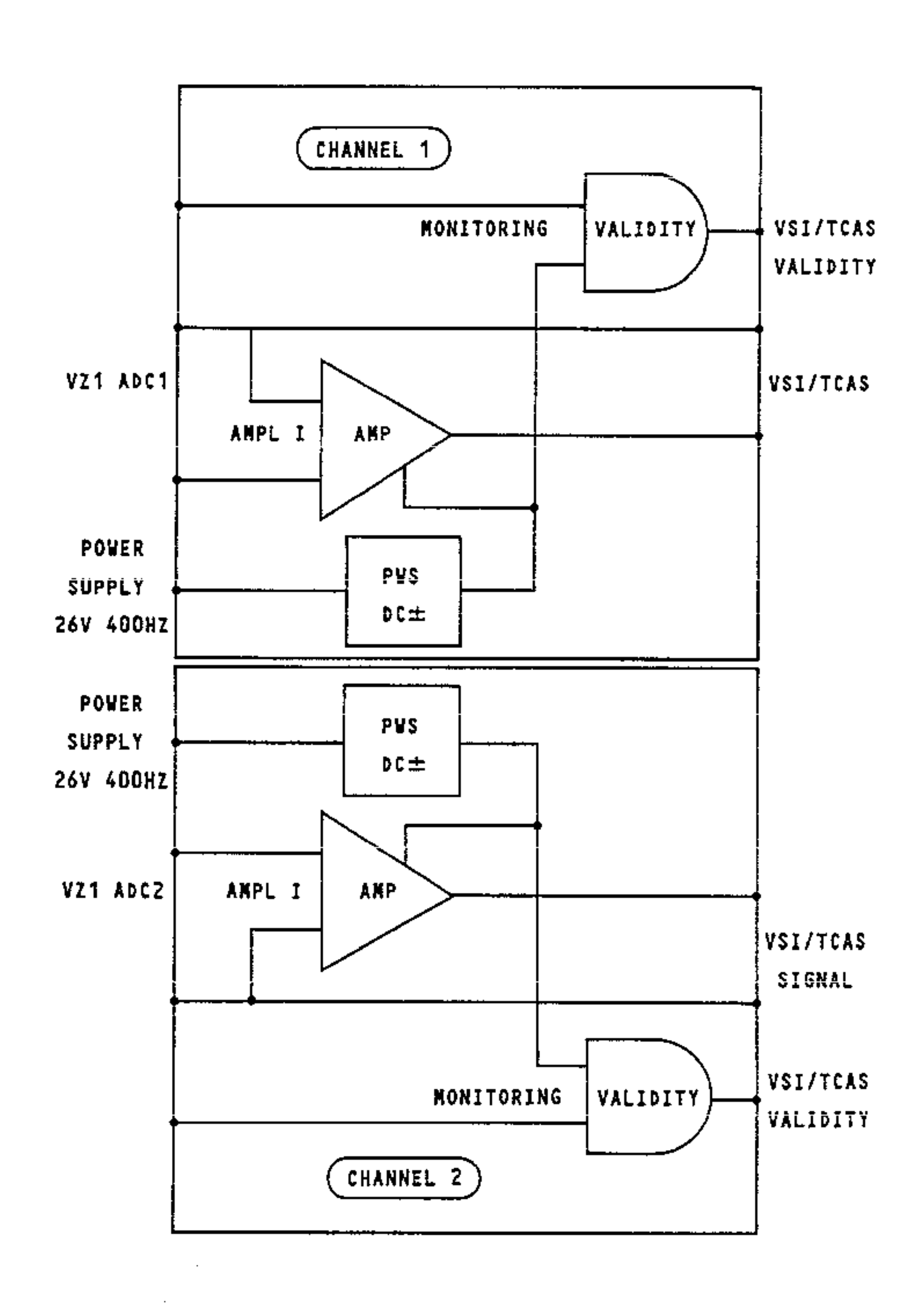
(2) Principle (Ref. Fig. 020)

(a) The amplifier adapts the vertical speed information (Vz) composed of a sinusoidal voltage variable in amplitude and phase with constant frequency.

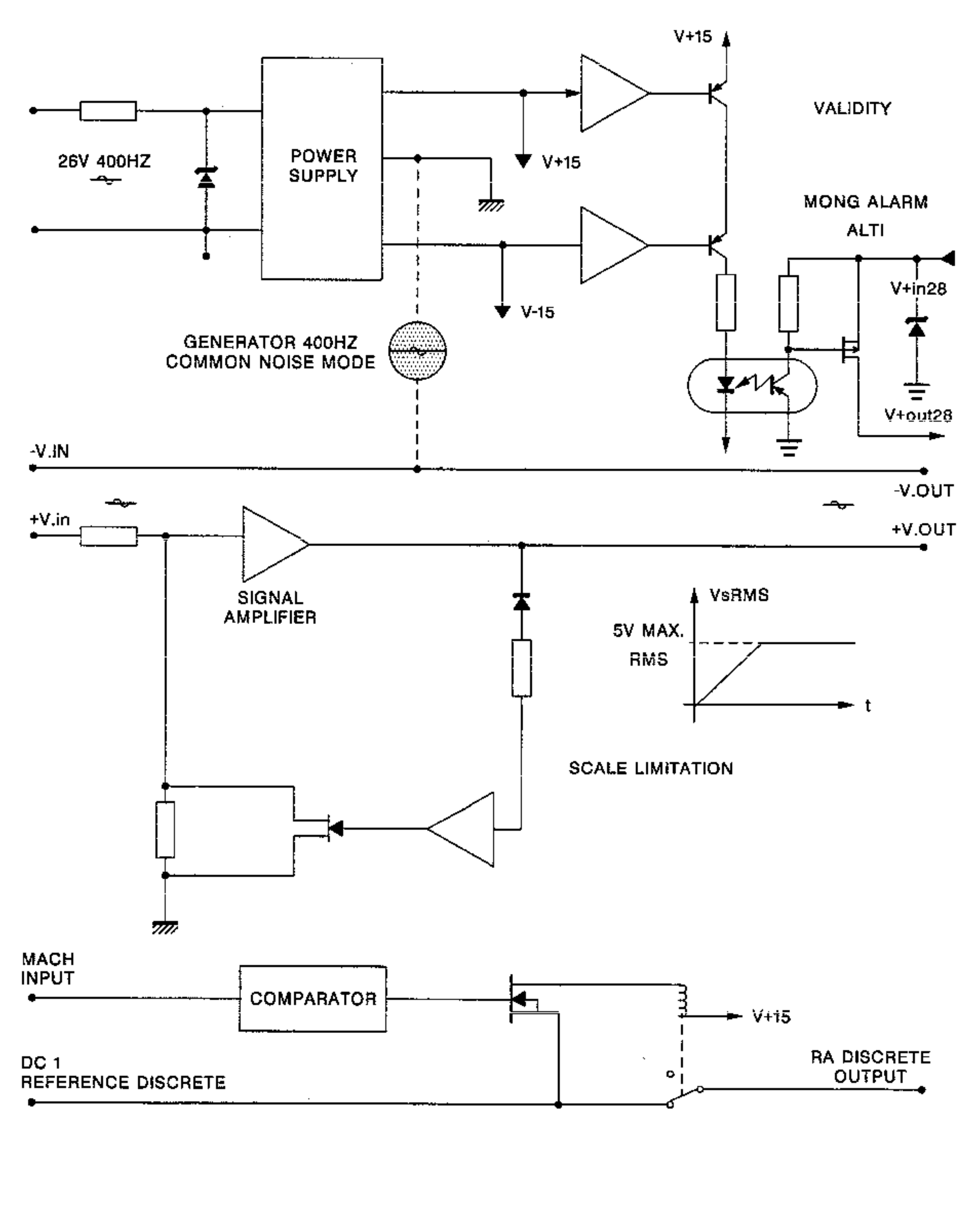
Each board of each channel has :

- an amplifier conditioning the air data signal from the ADC
- an internal power supply to supply the amplifier
- a scale limiter for limitation to 20,000 ft/min
- one monitoring system, indicating channel validity.

RB (b) The Mach 1 RA inhibit switch only works when ADC
RB No.1 ON/OFF switch is in the ON position. The RA
RB inhibit switch is a relay which is energized below
RB a speed of Mach 1, when ADC No.1 is ON.
RB Above Mach 1, the relay is de-energized and
RB applies a ground to the RA inhibit pin on the TCAS
RB computer. With the RA inhibit activated with the
RB ground signal, no TCAS RA's or any other aurals
RB are produced by the TCAS system.
RB The Mach 1 switch has also been utilised in a BA
RB modification to increase the volume of the PA
RB above Mach 1, when the ambient cabin noise
RB increases (Ref. 23-31-00).



TCAS - ADC Amplifier - Principle
Figure 019



R

TCAS - ADC Amplifier - Schematic
Figure 020

(3) Characteristics

Amplifier characteristics are as follows:

SIGNAL processed : sinusoidal voltage with a variable amplitude from 0 to 6 V RMS and 400 Hz frequency in phase or in phase opposition with the reference 26 V AC.

TRANSFER FUNCTION : Vs/Ve = 1.25

Gain ACCURACY : 0.5 %

Output voltage limitation : 5 V RMS

Signal PHASE SHIFT with respect to input signal : 1 degree maximum

SIGNAL IN QUADRATURE introduced by the amplifier : 6 mV RMS maximum

NOISE LEVEL introduced by the amplifier : less than 0.75 mV or 0.8 % of the signal (highest value)

INPUT IMPEDANCE : 50000 Ohms resistive load minimum

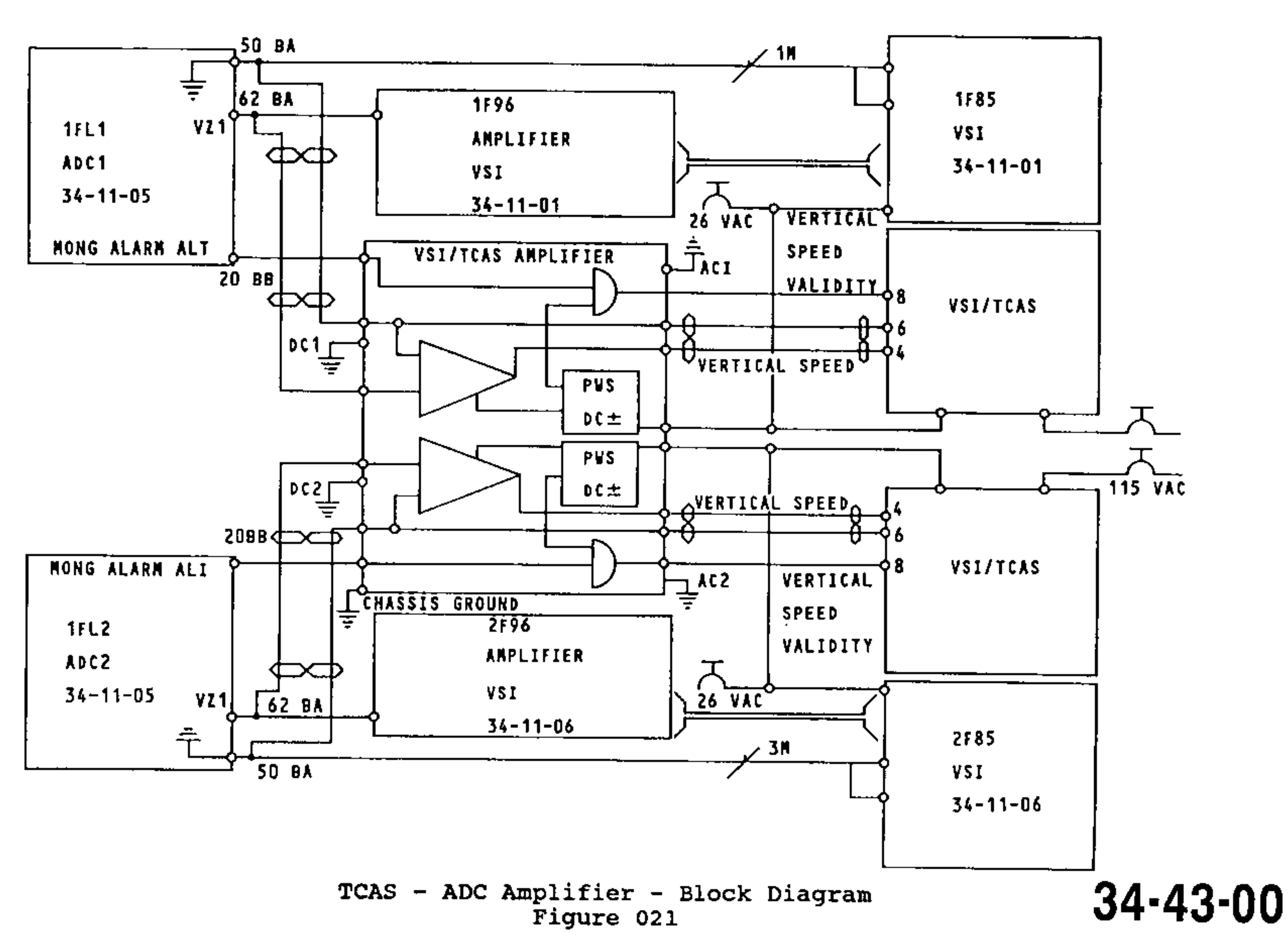
OUTPUT IMPEDANCE : 200 Ohms maximum

SUPPLY VOLTAGE : 26 V AC 400 Hz.

B. Operation (Ref. Fig. 021)

The amplifier supplies vertical speed (Vz) data to the VSI/TCAS indicators (size 3ATI) in the form of analog data to ARINC 565 ADC standard.

The CROUZET air data computer installed on Concorde supplies vertical speed information in the form of a 400 Hz AC signal phase referenced to a voltage of 26 VAC and whose amplitude is proportional to the vertical speed value.



TCAS - ADC Amplifier - Block Diagram
Figure 021

To integrate the TCAS function with respect to the Concorde basic VSI indicators, whose Vz range is ± 12,000 ft/min, the VSI/TCAS uses in parallel the vertical speed signals from the ADC adapted by the amplifier. Each amplifier has its own power supply whose source is taken from the reference 26 VAC 400 Hz of each TCAS/VSI.

8. Audio mixing box (S89)

A. Description

(1) General (Ref. Fig. 006)

The equipment is housed in a painted light alloy box with an Alodine protective treatment. The base of the box is not painted to permit chassis earthing.

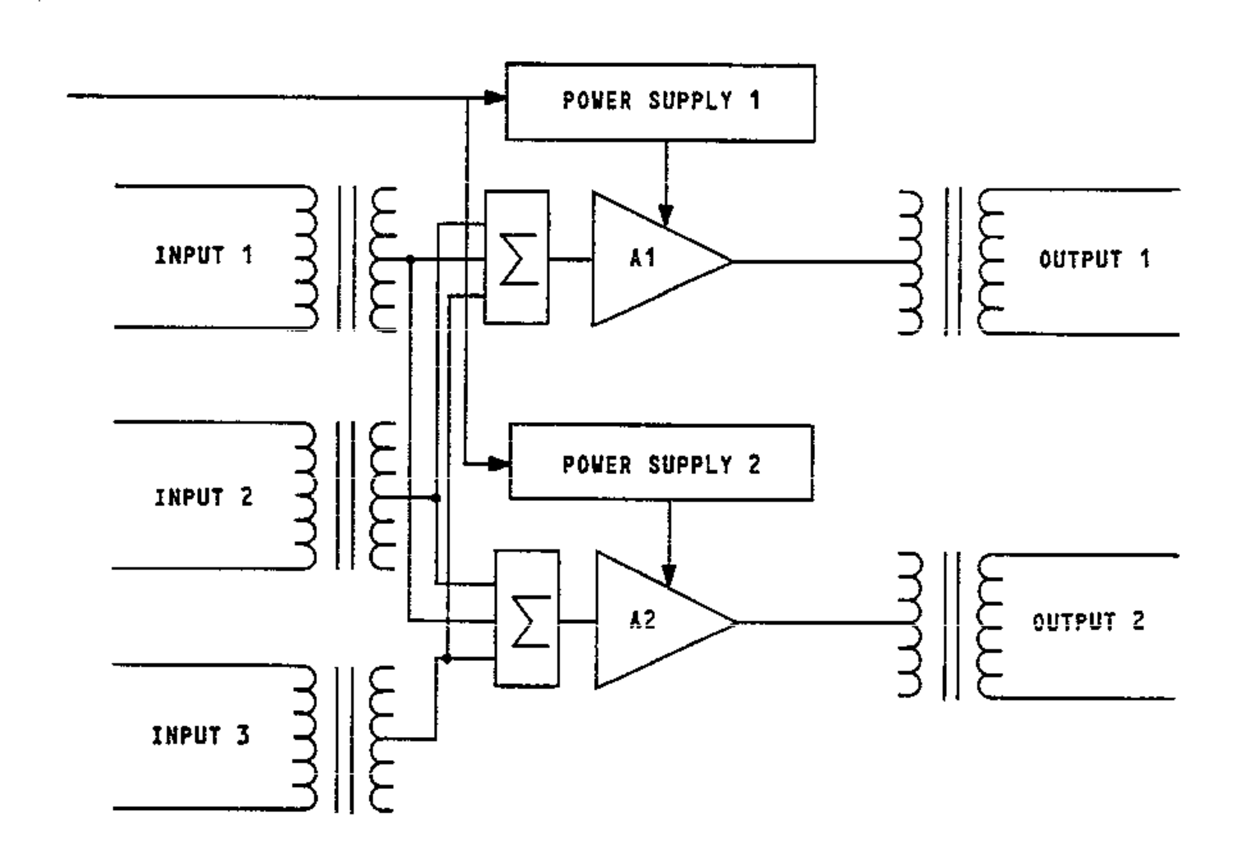
The function of this box is to :

- Adapt levels and signals.
- Sum the low frequency audio signals.

(2) Principle (Ref. Fig. 022)

The audio mixing box consists of :

- three separate and galvanically isolated inputs.
- two separate and galvanically isolated outputs.
- one electronic circuit for adapting and summing.



34 43 00 022A

TCAS - Audio Mixing Box - Schematic
Figure 022

(3) Characteristics

(a) Input

	Input Number		
	1	2	3
Band Pass	300 to 6000 Hz		
Impedance	5000 ohms		600 ohms
Input level	5.5 V max (2.5 v nominal)		
Distortion	Less than 3 %		
$\frac{S + N}{N}$	more than 80 db		

Input No. 1 : This input is dedicated to the CVR audio signal supplied by the audio system.
Input No. 2 : This input is dedicated to the synchronization signal supplied by the FDAU.
Input No. 3 : This input is used for the TCAS.

NOTE : The three inputs are isolated from ground. Non-utilization of one of the three inputs does not disturb audio mixing box operation.

(b) Mixing circuit

Band pass	300 to 6000 Hz
Distortion	Less than 3 %
Gain	0 dB
$\frac{S + N}{N}$	more than 80 dB

(c) Outputs

	1	2
Band Pass	300 to 6000 Hz	
Impedance	5000 ohms	600 ohms
Distorsion	Less than 3 %	
$\frac{S + N}{N}$	more than 80 dB	

Output No. 1 : This output is dedicated to the CVR circuit (See ARINC 557).

Output No. 2 : This output is dedicated to specific adaptation (mixing of TCAS and GPWS warnings).

NOTE : The two outputs must be isolated from ground. Non-utilization of one of the two outputs does not disturb audio mixing box operation.

(d) Power supply

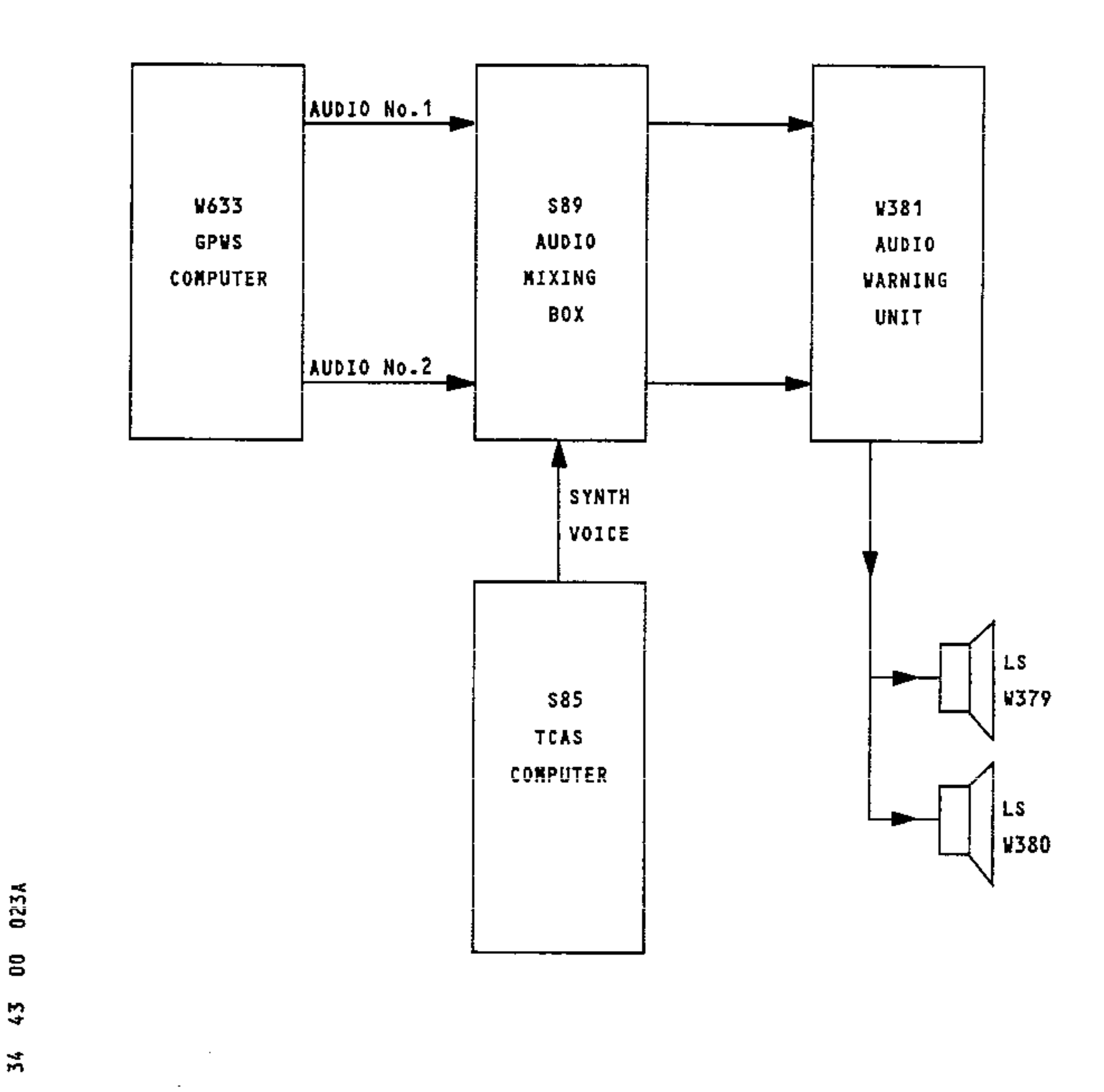
The audio mixing box is powered by 28 V DC.

B. Operation (Ref. Fig. 023)

For detail, See 31-23-00.

The mixing box receives audio output signals 1 and 2 from the GPWS (W633). It also receives a synthesized voice from the TCAS computer (S85) informing the crew of actions to be performed when the aircraft is operating in the TCAS mode.

This information is output to the audio warning unit (W381) that sends it to the CVR loudspeakers (W379, W380).



TCAS - Audio Mixing Box - Interconnection
Figure 023



TRAFFIC COLLISION AVOIDANCE SYSTEM (TCAS) - TROUBLE SHOOTING

CAUTION: OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The Table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

NOTE: Refer to 34-52-00 for trouble shooting processes for TCAS, ATC 1 and ATC 2.

2. Prepare

A. Equipment and Materials

	DESCRIPTION	PART NO.
	Electrical Ground Power Unit	-
RB	TCAS - 201 RAMP TEST SET (IFR)	TCAS 201
	One Simulator - Pressure Sensors or Pressure Generator	PN87209455
	One Boomset	From TE2037000
	One Ground Service Microphone/ Headset for Service Interphone	From TE2037000

B. TCAS trouble shooting can be carried out in a hangar if the antennae are clear of all obstacles and aircraft is on the ground, L.G. shock absorbers compressed.

C. On centre console panel (9-211), on ADC control unit ensure that:

- ADC1 and ADC2 ON-OFF switches are in OFF position

- Test selector switches are in NORM position.

D. On centre console panel (9-211), on ATC/TCAS control panel ensure that:

- XPDR1-2 selector switches are in 1(2) position

- Switch STBY - XPDR - TA - RA/TA selector switch to STBY position.

E. Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

F. Switch on electronics rack ventilation system (Ref. 21-21-00).

G. Ensure that the following circuit breakers are set:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No. 1 INPH SUP	1-213	R 89	K19
1ST PLT AUDIO SELECTOR SUP		R 241	L21
LH U/C WEIGHT SW "A" SYS SUP		G 292	M17
ADC1 28 V SUP		1F 74	P12
STICK SHAKER SUP		W 513	P15
ADC1 26 V SUP	2-213	1F 78	A 2
1ST PLT VSI SUP		1F 97	A 3
1ST PLT ALT ASI STBY IND		1F 88	B 1
2ND PLT ALT ASI STBY IND		2F 88	B 2
1ST PLT ADC INST SUP		1F 75	B 3
ADC1 115 V SUP		1F 73	F 3
ATC1 MODE S		S 13	G20
FLT CONT & NAV BUS 14XS		X 355	H 2
RH U/C WEIGHT SW "B" SYS SUP	3-213	G 294	B 9
No. 2 INPH SUP		R 90	H 2
2ND PLT AUDIO SELECTOR SUP		R 242	H 3

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC2 28 V SUP	5-213	2F 74	F12
TCAS	13-215	S 86	D 4
VSI/TCAS PILOT		S 95	E 4
2ND PLT ADC INST SUP	13-216	2F 75	A14
2ND PLT VSI SUP		2F 97	B13
ATC2 MODE S		S 14	F 7
VSI/TCAS CO-PILOT		S 96	F 8
ADC2 26 V SUP		2F 78	F14
ADC2 115 V SUP		2F 73	F15
NAV INST BUS 13X		X 345	G 4
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8

H. On jack panel, LH side console 1-211 (RH side console 1-212):

- connect boomset to BOOM connector
- place MIC SELECT OXY-BOOM switch in BOOM position.

I. On ground service jack R76 (zone 124), (R95 zone 123).

J. Switch on interphone system and establish connection (Ref. 23-41-00, Adjustment/Test).

K. On altimeters on Captain and First Officer instrument panels check that mode selector knob is positioned so as to leave letter N visible, then select barometric pressure of 1013.2 mb.

NOTE : For altitude corrections to apply during use of pressure generator or pressure sensor simulator, refer to Chapter 34-11-00, Servicing.

3. Trouble Shooting

```
***********************************************************
* Check lighting of the front face of the ATC Mode S/TCAS  *
* [1] control panel with SW L383 of the LIGHTING CENTRE    *
* CONSOLE PANEL. Front face lighting must vary.  IF        *
***********************************************************
      ||    |
      ||    |          ------------------------------------
      ||    |          | No control panel illumination.   |
      OK    └NOT OK----- | Ref. Chart 101                 |
      ||               ------------------------------------
***********************************************************
* Perform TCAS test on control panel [1]. Place test       *
* selector switch in STBY position :                       *
* - Place XPDR selector at 1 then 2                        *
* - Press TEST pushbutton.                                 *
* If the functional test is OK, PASS is displayed.         *
***********************************************************
      ||    |
      ||    |          ------------------------------------
      ||    |          | FAIL is displayed automatically. |
      OK    └NOT OK----- | Ref. Chart 102                 |
      ||               ------------------------------------
      ||               ------------------------------------
      ||               | Replace control unit.            |
      ||               ------------------------------------
***********************************************************
* On the front face of each computer TCAS (S85) [3] in     *
* zone 5-215, perform the functional test.                 *
* Press the test pushbutton.                               *
* The PASS indicator comes on green.                       *
***********************************************************
      ||    |
      ||    |          ------------------------------------
      ||    |          | The fail indicator comes on red. |
      OK    └NOT OK----- | Ref. Chart 103                 |
      ||               ------------------------------------
***********************************************************
* The VSI/TCAS Pilot [4] and Co-pilot [5] are identical    *
* configuration IF (Ref. Fig. 101).                        *
***********************************************************
      ||    |
      ||    |          ------------------------------------
      OK    └NOT OK----- | The VSI/TCAS Pilot [4] and Co-pilot|
      ||    |          | [5] indicate the fail function.  |
      ||    |          | Ref. Chart 104.                  |
      ||    |          ------------------------------------
      ||    |
      ||    |          ------------------------------------
      ||    └NOT OK----- | Test functional of VSI Pilot [4] |
      ||               | and Co-pilot [5].  (Ref. Chart 105)|
      ||               ------------------------------------
```

```
      ||
      ||
      ||
      OK
      ||
      ||
*************************************************************
* At the end of the test sequence the system generates a    *
* synthesized voice message "TCAS SYSTEM TEST OK" if the    *
* system is OK or                                           *
*************************************************************
      ||    |
      ||    |                 ----------------------------------------
      ||    |                | The message is "TCAS SYSTEM TEST FAIL" |
      OK    └NOT OK------    | Ref. Chart 106                         |
      ||                      ----------------------------------------
      ||
*************************************************************
* Check top antenna [9] and bottom antenna [10]             *
* (Ref. WDM 34-43-11).                                      *
*************************************************************
      ||    |
      ||    |                 ----------------------------------------
      ||    |                | Replace top antenna [9] or bottom      |
      OK    └NOT OK------    | antenna [10].  After replacing antenna |
      ||                     | measure SWR with the meter in the      |
      ||                     | feeder.                                |
      ||                      ----------------------------------------
      ||
      ||
*********************          *********************
* Check wiring.     *----+----* NOTE              *
* Ref. WDM 34-43-11 *          * Ref. Chart 107    *
*********************          *********************
```

```
*************************************
* NO ILLUMINATION OF CONTROL PANEL *
*************************************
```

MEASURE 115 V AC AT OUTPUT OF CIRCUIT BREAKER [2]

- 115 V AC → Ref. Circuit WDM 33-17-04 (INST LTG CONSOLES CENTRE)
- OK → Check voltage at input of circuit breaker.
  - 0V → Ref. AC DIST 24-51-14
  - 115 V AC → Replace circuit breaker [2].

Chart 101

****
* IN THE WINDOW OF THE CONTROL UNIT [1], *
* FAIL IS DISPLAYED, A FAULT IS DETECTED.*
****

To determine the type of control unit [1] fault :
- de-energize the unit
- put the functional test discrete to ground
- restore electrical power
- FXX (fault code) appears in the display window.

- Fault code - See table

FUNCTIONAL TEST DISPLAY	CONDITION INDICATED	BIT	CODE "F"
PASS	No fault detected. User must check display operation.		
F01	EPROM (electrically programmable read-only memory) check sum fault detected.	X	X
F02	RAM (random access memory) fault detected.	X	X
F04	Hardware internal clocks faulty.		
F08	Inter-processor communication fault.	X	
F10	EEPROM (electrically erasable read-only memory) fault. All locations are probably incorrect.	X	X
F20	Difference of configuration between control cards	X	X

To exit this mode :

Press any key on the control unit.

NOTE : If several faults occur at the same time, the fault code displayed represents the sum of all the fault codes present. Code F08 is only displayed when the functional test is initiated from the rear connector.

Chart 102

****
* ON THE FRONT OF EACH TCAS COMPUTER [3], THE FAIL INDICATOR *
* LIGHT COMES ON RED. THIS MEANS THAT FAULT IS DETECTED ON AN *
* TCAS OR PERIPHERAL CIRCUIT. *
****

Faults detected during a self-test are indicated in Table below.

INDICATOR CONTROL	FUNCTION
TTR	
PASS	The PASS indicator (green light) will light whenever the BITE self-test is successful.
FAIL	The FAIL indicator (red light) will light whenever the BITE self-test detects a failure.
XPDR	Light to indicate transponder or data link interface failure.
UPPER ANT	The UPPER ANT indicator (red light) will light during the self-test whenever the impedance of the upper antenna does not meet specification.
LOWER ANT	The LOWER ANT indicator (red light) will light during the self-test whenever the impedance of the lower antenna does not meet specification.
RAD.ALT	The RAD.ALT indicator (red light) will light during the self-test whenever the radio altimeter data is missing.
HDNG	The HDNG indicator (red light) will light during the self-test whenever the heading data is missing.
R/A	The R/A indicator (red light) will light during the self-test whenever the resolution advisory function indicator fails.
T/A	The T/A indicator (red light) will light during the self-test whenever the traffic advisory function indicator fails.
TEST	The TEST pushbutton indicates a self-test when pressed.

Chart 103

```
*********************************************
* The VSI/TCAS Pilot [4] and Co-pilot [5]   *
* indicate the fail function                *
*********************************************
```

Extended Test Sequence (Ref. Fig. 101)

If the TEST is held pressed in for longer than nine seconds the extended test sequence is initiated and will run as long as the button is pressed.

The VSI/TCAS indicator displays the part number software for 5 seconds and then the test results display with FAIL for failed equipment and OK for the others.

Chart 104

****
* Functional Test of VSI Pilot and Co-Pilot [4] and [5] *
****

VSI/TCAS test (Ref. Fig. 102)

In order to check the integrity of the indicator, a self-test function is provided and may be activated :

- by a flush push button located in the upper left corner of the bezel,
- by grounding a specific discrete input.

As long as it is activated, the indicator displays :

- vertical coloured bands (white, red, black, green, blue),
- the P/N software suffix (4 digits) of the instrument,
- The result of the internal monitoring tests performed.

Chart 105

```
**************************************************
* The system generates a synthesized voice message*
*       "TCAS SYSTEM TEST FAIL"                   *
**************************************************
```

If an anomaly has been detected.

In this case, the test results display shows "FAILS" instead of "OK".

RB In addition the front of the TCAS computer displays an LED
RB identifying the failed equipment.

Chart 106

NOTE: TCAS frame on TCAS-DISP ARINC 429 bus

For more in-depth checks, validity of the information transmitted by the TCAS computer to the indicators must be checked by connecting an ARINC 429 bus tester to the TCAS-DISP high speed buses linking the TCAS computer to the VSI/TCAS indicators.

The labels transmitted on this bus come from various sources :

- labels generated by the TCAS computer,
- labels from the control unit and passing successively through the transponder and the TCAS computer,
- labels received and re-issued by the transponders and passing through the TCAS computer.

The following table summarizes the function of each label and its source.

Chart 107, 1/5

LABEL	BITS	PARAMETER	SOURCE	DATA RATE MIN	DATA RATE MAX
013	9-10 11 12-13 14 15-21 22-29	Destination displays Intruder type-Relative/ Absolute Altitude surveillance zone All Traffic/Threat traffic selection Spare TCAS range (NM)	Control unit via transponder	100 ms	200 ms
015	9-10 11-17 18-24 25-29	Destination displays Altitude zone A value Altitude zone B value Spare	Control unit via transponder	300 ms	500 ms
016	9-10 11 12 13-14 15-17 18-19	Destination displays "Altitude reporting" selection "Ident" p/b active (control panel) Displays functions TCAS operating mode on CTL PNL Mode A identification code	Control unit via transponder	100 ms	200 ms
203	9-10 11-29	SDI Standard barometric altitude	ADC via transponder	31,3 ms	500 ms
270	9-10 11-17 18-29	SDI Vertical speed value (RA) Advisory type definition	TCAS computer	300 ms	500 ms
274	9-22 23-25 26-29	Spare Sensibility level SL field Sensitivity level RI field	TCAS computer	300 ms	500 ms

Chart 107, 2/5

LABEL	BITS	PARAMETER	SOURCE	DATA RATE MIN	DATA RATE MAX
350	9-10	SDI	TCAS computer	500 ms	1000 ms
	11	1 = TCAS failure			
	12	1 = TCAS top antenna failure			
	13	1 = TCAS bottom antenna failure			
	14	1 = Radio alt ≠ 1 bus inactive			
	15	1 = Radio alt ≠ 2 bus inactive			
	16	1 = XPDR ≠ 1 inactive or failed			
	17	1 = XPDR ≠ 1 inactive or failed			
	18	1 = Altitude bus inactive			
	19	1 = Magnetic heading bus inactive			
	20	1 = TCAS system failure			
	21	Spare			
	22	Spare			
	23	1 = VSI/TCAS ≠ 1 failure RA function			
	24	1 = VSI/TCAS ≠ 2 failure RA function			
	25	1 = VSI/TCAS ≠ 1 failure TA function			
	26	1 = VSI/TCAS ≠ 2 failure TA function			
	27	1 = CFDIU bus inactive			
	28	1 = BITE test inhibition			
	29	1 = Command word acknowledgment			
356	9-31	Message text characters	TCAS computer	100 ms	3000 ms
357/ RTS	9-16	Number of words in intruder file	TCAS computer	Twice/second	
	17-18	Spare			
	19	TA/RA ONLY or ALL TRAFFIC display			
	20-24	Number of displayed intruders programming			
	25-31	DC2 character			

Chart 107, 3/5

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LABEL	BITS	PARAMETER	SOURCE	DATA RATE MIN	DATA RATE MAX
357	9-16	Number of words in intruder file	TCAS computer	Twice/second	
	17-24	Spare			
	25-31	ETX character			
130	9-10	SDI bits set to 0	TCAS computer	Twice/second	
	11-15	Intruder number			
	16-18	Intruder sensitivity level			
	19-29	Intruder range			
131	9-10	SDI bits set to 0	TCAS computer	Twice/second	
	11-15	Intruder number			
	16-19	Spare			
	20-21	Intruder vertical speed sense			
	22-29	Intruder relative altitude			
132	9-10	SDI bits set to 0	TCAS computer	Twice/second	
	11-15	Intruder number			
	16-18	Intruder type			
	19-29	Bearing			

Chart 107, 4/5

Labels 130, 131, 132 and 203 are BNR with SSM :

Bit 31	Bit 30	Signification
0	0	Failure warning
0	1	No computed data
1	0	Functional test
1	1	Normal operation

Labels 013, 015, 016, 270, 274 and 350 are DISC with SSM :

Bit 31	Bit 30	Signification
0	0	Normal operation
0	1	No computed data
1	0	Functional test
1	1	Failure warning

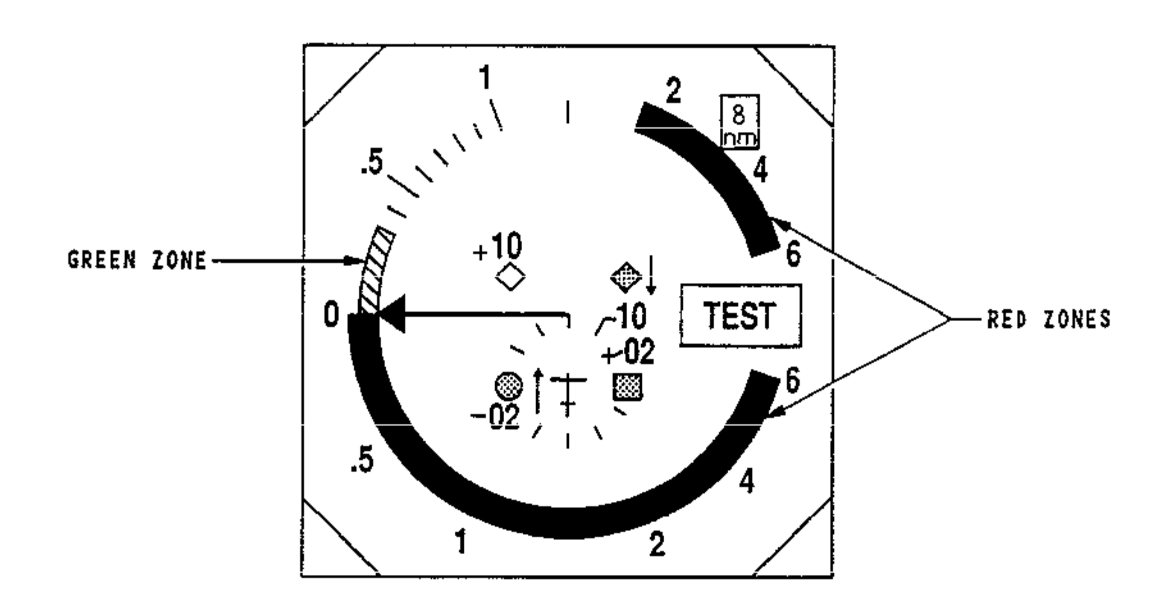
Labels 356 and 357 are ISO ≠ 5 and have no SSM.

Chart 107, 5/5

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL MAIN. TOPIC	MANUAL WIRING DIAGRAM
[1] Control panel ATC Mode S/TCAS		9-211	S11	FLT CPT	34-52-13 R/I	34-52-01
[2] Circuit breaker CTR CONSOLE INST LTS SUP		14-216	L405	B8	24-50-00 R/I	33-17-04
[3] TCAS computer	Door DS	5-215	S85	Electronics rack LH	34-43-33 R/I	34-43-01
[4] VSI Pilot		2-211	S87	Inst Panel Pilot	34-43-23 R/I	34-43-01
[5] VSI Co-Pilot		2-212	S88	Inst Panel Co-Pilot	34-43-23 R/I	34-43-01
[6] Circuit breaker TCAS computer		13-215	S86	D4	24-50-00 R/I	34-43-01
[7] Circuit breaker VSI/TCAS Pilot		13-215	S95	E4	24-50-00 R/I	34-43-01
[8] Circuit breaker VSI/TCAS Co-Pilot		13-216	S96	F8	24-50-00 R/I	34-43-01
[9] Top antenna TCAS		Zone 215	S112	Between FR9 FR10	34-43-11 R/I	34-43-01
[10] Bottom antenna TCAS		Zone 123	S111	Between FR9 FR10	34-43-11 R/I	34-43-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL MAIN. TOPIC	MANUAL WIRING DIAGRAM
[11] Amplifier -ADC, VSI/TCAS		17-215	S94	Electronics Rack LH	/	34-43-01
[12]Mixing Box-Audio		5-215	S89	Electronics Rack LH	/	34-43-01

Component Identification
Table 101



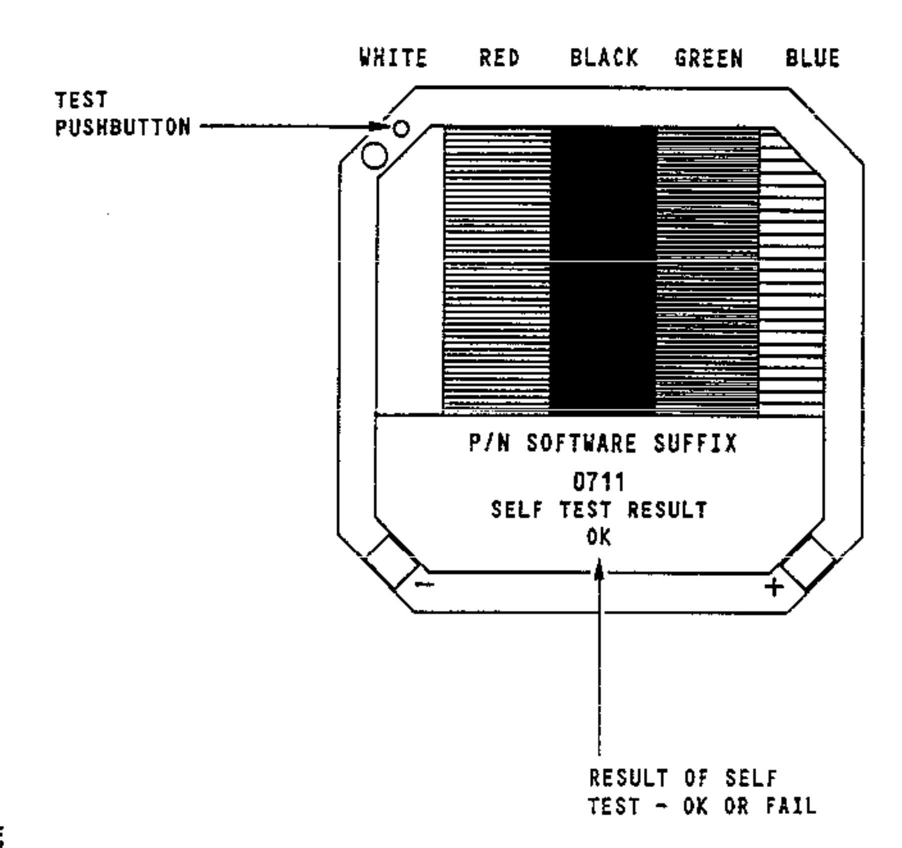
1 2 .5 4 6 0 6 .5 4 1 2

TEST

TCAS	OK
TRANSP	1:OK 2:OK
ANTENNA	U:OK L:OK
RADIO ALT	1:OK 2:OK
ATTITUDE	OK
HEADING	OK
RA DISP	1:OK 2:OK
TA DISP	1:OK 2:OK

34 43 00 101A

TCAS Self-Test
Figure 101



Indication Self-Test Pattern
Figure 102

TRAFFIC COLLISION AVOIDANCE SYSTEM (TCAS) - ADJUSTMENT/TEST

R 1. General

R A. This procedure contains two sets of tests. One is an Operational Test and the other is a System Test. The Operational Test is a simplified check of the TCAS System. The System Test is a detailed check which first performs the Operational Test and then, using Test Equipment, generates simulated targets to activate the TCAS logic and target displays for assessment of bearing capability, aural advisories and inhibits etc.

R 2. Operational Test

R A. General

R This test checks the TCAS for correct operation using only the system's BITE function, with no special Test or Ground equipment required.

R B. TCAS Tests - Initial Conditions

R (1) Aircraft position and configuration:

R (a) Aircraft on ground on its wheels.

R (b) Aircraft electrical network energized as detailed in 24-41-00 Servicing.

R (c) Zones around TCAS antennae and Mode S ATC 1/2 antennae clear to a radius of 98.43 ft (30 m) (approx.).

R (d) TCAS and ATC circuits serviceable.

R (e) Following peripherals serviceable.

R - Radio Altimeter
R - ADC
R - INS
R - Compass Coupler

R C. Close the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYS 1 SW SUP	1-213	1F 134	F14
VHF1 SUP	1-213	1R 17	J19
No. 1 INPH SUP	1-213	R 89	K19
1ST PLT AUDIO SEL SUP	1-213	R 241	L21
LH U/C WEIGHT SW "A" SYS SUP	1-213	G 292	M17
RH U/C WEIGHT SW "A" SYS SUP	1-213	G 295	M18
AUDIO WARN SYS SUP1	1-213	W 371	M21
ADC1 28V SUP	1-213	1F 74	P12
STICK SHAKER SUP	1-213	W 513	P15
INS Ref. AMM 34-45-00 Page 500			
ADC1 26V SUP	2-213	1F 78	A 2
1ST-PLT-ALT ASI STBY IND	2-213	1F 88	B 1
2ND-PLT-ALT ASI STBY IND	2-213	2F 88	B 2
1ST PLT ADC INST SUP	2-213	1F 75	B 3
RAD ALT1 SUP	2-213	1S 56	D 8
ADC 115V SUP	2-213	1F 73	F 3
COMPASS COUPLER 1 SUP	2-213	1F 130	F 8
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
LH U/C WEIGHT SW "B" SYS SUP	3-213	G 293	B 8
RH U/C WEIGHT SW "B" SYS SUP	3-213	G 294	B 9
No. 2 INPH SUP	3-213	R 90	H 2
2ND PLT AUDIO SELECTOR	3-213	R 242	H 3
AUDIO WARN SYS SUP2	5-213	W 372	C17
ADC2 28V SUP	5-213	2F 74	F12
COMPASS COUPLER 2 STBY SUP	13-215	2F 131	B 7
VSI/TCAS PILOT	13-215	S 95	E 4
GRD PROXIMITY WARN AC SUP	13-215	W 631	G 4
2ND PLT ADC INST SUP	13-216	2F 75	A14
COMPASS COUPLER 2 NORM SUP	13-216	2F 130	D15
CSI/TCAS CO-PILOT	13-216	S 96	F 8
ADC2 26V SUP	13-216	2F 78	F14
ADC2 115V SUP	13-216	2F 73	F15
RAD ALT2 SUP	13-216	2S 56	F19
NAV INST BUS 13X	13-216	X 345	G 4
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8
RAD ALT1 AND 2 SUP	15-216	S 57	C 5
COMPASS COUPLER SYS 2 SW SUP	15-216	2F 134	A21

Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 MODE S	2-213	S 13	G20
TCAS	13-215	S 86	D 4
ATC2 MODE S	13-216	S 14	F 7

D. Test Procedure

(1) On ATC/TCAS control unit.

(a) Place XPDR selector switch in position 1.

(b) Place STBY-XPDR-TA-RA/TA selector switch in TA position.

(c) Place ALT RPTG selector switch in position 1 or 2.

(d) A-N-B selector switch to N.

(e) On radio altimeter indicators, make sure that radio altimeters 1 and 2 operate correctly.

(f) On Captain and First Officer's VSI/TCAS indicators, check that RA FAIL and TCAS FAIL messages are displayed.

(g) Make sure that INS1/2, ADC1/2, compass coupler and radio altimeter selector switches are in ON position.

(h) Close the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 MODE S	2-213	S 13	G20
TCAS	13-215	S 86	D 4
ATC2 MODE S	13-216	S 14	F 7

(i) On ATC/TCAS control unit, last code displayed appears in display window.

(j) On VSI/TCAS indicator, check that:

- RA FAIL message disappears.
- TCAS FAIL message disappears (if INS1 is aligned).
- Check that the pointer, vertical speed scale, aircraft symbol, RANGE indication and TA ONLY flag are displayed.

(2) Self test on ATC/TCAS control unit (Ref. Fig.502).

(a) On ATC/TCAS control unit, press and release the TEST pushbutton switch and check that:

- XPDR/FAIL indicator light illuminates for 3 seconds (approx.) and PASS comes into view on display window.

(b) Simultaneously check the indications that appear on the VSI/TCAS indicators.

- The TCAS-equipped aircraft is depicted by an aircraft symbol in the form of a white cross located at the bottom of the display. The scale of the display is such as to show 6.5 Nautical Miles (NM) ahead and 2.5 NM behind aircraft symbol.
- A white range ring with markings at each of the twelve clock positions is placed around the aircraft symbol at a radius of 2 NM.
- RA ( ) appears at approx. 2 NM, at 3 o'clock, with relative altitude indication (next to RA) of +02 (+200 ft) without rate altitude arrow.
- TA ( ) appears at approx. 2 NM, at 9 o'clock, with relative altitude indication (next to TA) of +02 (-200 ft) with a climb tendency (rate altitude arrow towards the top).
- PROXIMATE ( ) appears at approx. 3.625 NM, and at approx. 1 o'clock (33.75 deg. right) with relative altitude indication of -10 (-1000 ft) with a descent tendency (rate altitude arrow towards the bottom).

- OTHER (◇) appears at approx. 3.625 NM, and at approx. 11 o'clock (33.75 deg. left) with relative altitude indication (next to OTHER) of +10 (+1000 ft) without rate altitude arrow.
- TEST appears at 3 o'clock on graduated dial.
- Simultaneously, red and green ranges must appear on the VSI/TCAS indicator:
- a red arc of + 2000 + 6000.
- a red arc of 0 - 6000.
- a green arc of 0 + 300 approx.

(c) TCAS SYSTEM TEST OK - aural message will be triggered at end of test.

(3) Extended self test.

(a) Initiate a TCAS system extended Self Test by depressing the TEST button on the ATC/TCAS Control Panel and keeping it pressed for more than 9 seconds.

(b) The previously described Self Test sequence will occur followed by a change of display on the IVSI's to list the condition/status of the Input Sensors (Ref. Fig. 505).

TCAS	OK	
TRANSP	1:OK	2:OK
ANTENNA	U:OK	L:OK
RADIO ALT	1:OK	2:OK
ATTITUDE	OK	
HEADING	OK	
RA DISP	1:OK	2:OK
TA DISP	1:OK	2:OK

(c) On release of the TEST button, the Aural annunciation "TCAS SYSTEM TEST OK" or "TCAS FAIL" will be generated.

(This extended Self Test is useful for fault finding in the event of a "Fail" being generated).

(4) ATC2/TCAS test.

(a) On ATC/TCAS control unit place XPDR 1/2 selector switch in position 2.

(b) Repeat test operations and ensure that the results are the same as to those indicated in para. 2.D.2.

(c) At the end of the test, place XPDR selector switch in position 1.

E. Replacement of TCAS System LRUs

After replacement of units in the TCAS system, prior to activating the extended self test on the control panel, individual self tests on the replacement units shall be performed.

(1) Self test of VSI/TCAS indicators.

(a) The self test can be activated:

- By pressing TEST pushbutton switch (1) located on front face of the indicator (Ref. Fig. 506), or:
- By placing 3-position D/B LIGHT selector switch in TEST position (left console 12-211). The indications on the IVSI/TCAS indicators are (Ref. Fig. 507):
- On Captain and First Officer VSI/TCAS indicators, TEST pattern is displayed. It comprises five vertical strips which are, from left to right, white, red, black, green and blue and below inscriptions P/N SOFTWARE SUFFIX XXXX (software number can evolve).
- SELF TEST RESULT OK is also displayed.

R (b) Press + or - pushbutton and check that range 16 NM, 8 NM or 4 NM is displayed on right upper window of the VSI/TCAS indicators:

R - with 16 NM range, check that graduations 6 NM and 2 NM are displayed.
R - with 8 NM range, check that graduations 2 NM are displayed.
R - with 4 NM range, check that graduations 2 NM are displayed.

R (2) Self test of ATC/TCAS control unit (9-211)

R (a) Set 3-position LIGHT selector LO/HI/TEST switch on centre console to TEST.

R (b) Check that on ATC/TCAS control unit (9-211).

R - Transponder FAIL light illuminates
R - F8888 appears in code display window.

R (c) Set LIGHT selector switch to LO.

R - Transponder FAIL light and F8888 indications disappear on the control unit.

R (3) Self test of transponders and TCAS computer.

R (a) Press the ATC/TCAS control panel TEST pushbutton switch and check on the front face of the ATC1/Mode S and ATC2/Mode S transponders and TCAS computer, that the sequences are carried out as follows:

R - all indicator lights come on for about 1 second
R - all indicator lights go off momentarily
R - TPR PASS and TTR PASS indicator lights come on
R - TPR PASS and TTR PASS indicator lights go off approximately 10 seconds after release of TEST pushbutton switch

(b) For LRU self test (approximate time is 12 seconds) (Ref. Fig. 503), on front face of ATC1/Mode S, ATC2/Mode S transponders and TCAS computer, perform following tests:

- On transponder No. 1 and No. 2, in turn, press TEST pushbutton and check illumination of indicator lights as per following table (Ref. Table 1).
- On front face of ATC/Mode S transponders.

CONTROL OR INDICATOR	ASSEMBLY CONCERNED	INDICATIONS PROVIDED BY THE INDICATOR LEDS
PASS TPR	TPR is the ATC/Mode S transponder	When illuminated, indicates that the TPR-720 ATC/Mode S transponder has passed the test.
FAIL		When illuminated, indicates that the TPR-720 ATC/Mode S transponder has failed the test.
UPPER ANT	Upper Antenna	When illuminated, indicates that an anomaly has been detected in the upper antenna circuits.
LOWER ANT	Lower Antenna	When illuminated, indicates that an anomaly has been detected in the lower antenna circuits.
ALT	Altimeter Data	When illuminated, indicates that no altimeter information is received by the TPR.
CTL	Control Unit	When illuminated, indicates an operating anomaly in the control unit circuits.
TEST	Pushbutton	Permits self-test of TPR-720. Test exercises circuits of TPR-720.

TABLE 1

R R R - On front face of TCAS computer press TEST pushbutton and check illumination of indicator lights as per following table (Ref. Table 2).

CONTROL OR INDICATOR	FUNCTION
TTR PASS indicator	Illuminates on completion of TTR-920 self-test to indicate TTR-920 has passed test.
TTR FAIL indicator	Illuminates on completion of TTR-920 self-test if TTR-920 has failed test.
XPDR indicator	Illuminates on completion of TTR-920 self-test if an associated transponder or data link interface has failed test.
UPPER ANT indicator	Illuminates on completion of TTR-920 self-test if upper TCAS antenna has failed test.
LOWER ANT indicator	Illuminates on completion of TTR-920 self-test if lower TCAS antenna has failed test.
RAD ALT indicator	Illuminates on completion of TTR-920 self-test if no radio altimeter information.
HDNG indicator	Illuminates on completion of TTR-920 self-test if no heading information.
R/A indicator	Illuminates on completion of TTR-920 self-test if resolution advisory indicator has failed.
T/A indicator	Illuminates on completion of TTR-920 self-test if traffic advisory indicator has failed.
TEST pushbutton switch	Permits initiating self-test of TTR-920. The test exercises the operation of the TTR-920.

TABLE 2

3. System Test

A. General

This System Test is a complete check of the TCAS. The System Test performs the TCAS Operational Test first and then using Test Equipment tests the TCAS fully.

B. Equipment and Materials

DESCRIPTION	PART NO.
Radio Altimeter Ground Test Unit	TRT-AHV5-018
ADC Simulator	87209455
IFR TCAS Test Set	TCAS201
VSWR Tester	QB8M
TCAS VSWR Adapter Kit	KIT4-99224
Bonding/ohm Meter	-
Access Platform	-
Antenna shield material	ECCOSORBAN79

C. Prepare for Continuity and VSWR checks

(1) Remove TCAS computer (Ref. 34-43-33, Removal/ Installation).

(2) Remove Mode S transponders (Ref. 34-52-33, Removal/ Installation).

(3) Remove DME interrogators (Ref. 34-51-33, Removal/ Installation).

D. Continuity Checks

(1) Check of suppressor connection.

Check continuity between the suppressor coaxial cable cores:

TCAS S85 - AC terminal 12
ATC1 1S10 - AC terminal 12
ATC2 2S10 - AC terminal 12
DME1 1S1 - AC terminal 12
DME2 2S1 - AC terminal 12

E. SWR (Standing Wave Ratio) and Antenna Electrical Bonding Measurements

(1) TCAS antenna electrical bonding.

Measure upper and lower TCAS antenna electrical bonding, between the head of each bolt and one point of the structure. Use a bonding/ohm meter to find the value of the resistance (r should be < than 5 mΩ).

(2) TCAS antenna SWR measurement.

Measurement: Use tester QB8M and adapter kit P/N KIT4-99224. Instructions are in sheet 2 of British Airways drawing 4-99224 but are summarised below for convenience.

VSWR check with antennae installed:

(a) Ensure that the TCAS processor is removed from the rack and insert the dummy loads (Item 2 and Item 3 of the kit) into three of the four ports for the top antenna in the ARINC 600 connector in the rack.

(b) After calibrating the ATC VSWR tester QB8M at 1030 MHz, connect the TCAS cable P/N 3C142B from the kit (part of Item 1 of the kit) to the bridge network on the QB8M. Attach the SMA to N-type adapter P/N 3080-2240-00 (part of Item 1 of the kit) to the cable, connect the QB8M 2:1 load and check that the VSWR is close to 2:1. Readjust the meter so it reads a VSWR of 2. Remove the load and adapter and screw in the ARINC 600 adapter P/N 620-044 (part of Item 1 of the kit) into the end of the cable. Insert this end into the one open port for the top antenna. Measure the VSWR at 1030 MHz. Ensure that the reading is better than 1.45:1.

(c) Remove one of the dummy loads and insert the lead into the newly vacated port. Relocate the removed dummy load into the open port and measure the VSWR.

(d) Measure the VSWR of the other antenna ports for the top antenna and then conduct the same tests on the bottom antenna connector. The VSWR in each case shoule be better than 1.45:1.

(e) Repeat setps (a) to (d) at 1090 MHz.

(f) Remove the test equipment and replace the TCAS processor.

<u>NOTE:</u> TCAS cable repair

The connection between the TCAS computer and each TCAS antenna is via 4 coaxial cables and meets ARINC 735 recommendations.

The original TCAS coaxial cables were manufactured with Filotex coaxial cable following a process defined by Aerospatiale. The characteristics were tested in factory (i.e. 0.27 dB/m attenuation at 1090 MHz).

During the manufacturing process, the margin between the coaxial cables did not exceed 20 cm or 8 inches.

Each coaxial cable can be repaired three times before the replacement of the whole cable, assuming during each repair a maximum of 5 cm or 2 inches is removed during cable repair.

After each repair, the TCAS installation has to be tested to measure the VSWR.

F. Replace Removed Units

(1) Replace TCAS computer (Ref. 34-43-33, Removal/ Installation).

(2) Replace Mode S transponders (Ref. 34-52-33, Removal/ Installation).

(3) Replace DME interrogators (Ref. 34-51-33, Removal/ Installation).

G. Prepare to System Test

(1) Repeat paras. 2.B and 2.C and isolate the emergency generator by placing NORMAL/ISOLATE switch X219 (6.214) in ISOLATE position.

(2) Perform Operational Test para. 2.D (Items 1 to 3).

R R H. Test of TCAS Operating Modes on VSI/TCAS Indicators Relative to Different Selections on ATC/TCAS Control Unit

R (1) Initiate test as described below:

R R (a) Ensure that preparation for System Test requirements in para.3.G have been performed.

R R (b) On ATC/TCAS control unit, set the selector switches to the following positions:

R R R R R
- STBY-XPDR-TA-RA/TA to RA/TA position
- ALT RPTG to 1
- XPDR 1/2 selector switch to 1
- On IVSI/TCAS indicators, check that "TCAS FAIL" message is not displayed.

R R R R (c) Plug in the radio altimeter test set (Ref. 34-42-00, Radio Altimeter Functional Test) and simulate an altitude of 1210 ft on the radio altimeters.

R R (d) Pull and reset the TCAS computer CB S86, map reference D4 on panel 13-215.

R R R R R NOTE: Altitudes of greater than 50 ft with the aircraft on the ground will cause a TCAS FAIL MESSAGE which can be cleared by pulling and re-setting the TCAS computer CB.

R R (e) On VSI/TCAS indicators, check that TA ONLY message is displayed.

R R (f) Simulate the aircraft in flight configuration by opening the following circuit breakers:

R R R R WARNING: ENSURE THAT THE EMERGENCY GENERATOR IS ISOLATED BY PLACING THE NORMAL/ISOLATE SWITCH X219 (6.214) IN THE ISOLATE POSITION.

R R R R R R R R R

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH UC WEIGHT "A" SYS SUP	1=213	G295	M18
LH UC WEIGHT "B" SYS SUP	3-213	G293	B 8

R R - On VSI TCAS indicators, check that TA ONLY message disappears a few seconds later.

R (2) On ATC/TCAS control unit, place the following selector switches as shown in table below:

ON ATC/TCAS CONTROL UNIT	ON CAPTION AND FIRST OFFICERS IVSIs
STBY-XPDR-TA-RA/TA on STBY. ALT RPTG-OFF on ALT RPTG 1	TCAS OFF
STBY-XPDR-TA-RA/TA on TA ALT RPTG-OFF on ALT RPTG 1	TA ONLY
STBY-XPDR-TA-RA/TA on RA/TA ALT RPTG-OFF on ALT RPTG 1	NO FLAG DISPLAYED
STBY-XPDR-TA-RA/TA on RA/TA ALT RPTG-OFF on ALT RPTG OFF	TCAS OFF

R (3) Place XPDR selector switch in position 2 and ALT RPTG to 2. Repeat test in preceding para. 3.H.2. Check same results are achieved.

R (4) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

R I. System Sensor Checks

R (1) TCAS/radio altimeter link test.

R NOTE: During TCAS extended self test, the TCAS-radio altimeter (1 and 2) links are validated by "RADIO ALT OK" message being displayed on the VSI/TCAS indicators.

R (a) Follow instructions in para. H.1. parts (a) to (f) if not continuing directly on from preceding para. H.1.

R (b) Open the following CBs:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD ALT 1 SUP	2-213	1S 56	D 7
RAD ALT 2 SUP	13-216	2S 56	F19

R - Check that TCAS FAIL message appears on both VSI/TCAS indicators (Captain and First Officer).

R (c) Alternatively close and open each one of the above circuit breakers and check that on each closure, "TCAS FAIL" is replaced by a "TA ONLY" message on the VSI/TCAS indicators (Ref. Fig. 508).

R (d) Close both circuit breakers tripped in (b).

R (2) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

R J. Test of TCAS-INS1 Link

R (1) Follow instructions in para. H.1 parts (a) to (f) if not continuing directly on from preceding para.

R NOTE: The correct link between the TCAS computer and the INS is indicated during the self test of the TCAS (para. 2.D) by the message "ATTITUDE:OK" displayed on the VSI/TCAS indicators.

R (2) Open the following CB:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADI 1ST PLT INS 1 SUP AND IND	2-213	1F15	B 7

(a) Conduct an extended self test by pressing the TEST pusbutton on the control panel for longer than 9 seconds.

NOTE: As the TCAS computer does not monitor pitch and roll data, the "ATTITUDE:OK" message appears on the VSI/TCAS indicator and "HEADING:FAIL" should be displayed as INS validity failure affects the validity of the Compass info. Also, as the INS supplies the compass coupler with the platform heading, the message "HEADING: FAIL" is displayed when the INS data is not available. TCAS has to be powered for more than 3 minutes for this to register.

(b) Close circuit breaker 1F15 and repeat the extended self-test again. On the VSI/TCAS indicator, check that "HEADING:OK" is displayed.

(3) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

K. Test of TCAS Compass Coupler Links

(1) Follow instructions in para. H.1 parts (a) to (f) if not continuing directly on from preceding para.

NOTE: The correct link between the TCAS and the compass coupler is indicated during the extended TCAS self test (para. 2.D) by the message "HEADING:OK" displayed on the IVSI/TCAS indicators.

(2) Open the circuit breaker:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER 1 SUP	2-213	1F130	F 8

(a) Perform the TCAS extended self test by pressing the test button on the control panel for longer than 9 seconds.

- On the VSI/TCAS indicators, "HEADING FAIL" message appears.

R (b) Close circuit breakers 1F130 and repeat the
R self-test.

R - On the VSI/TCAS indicators, "HEADING:OK"
R message appears and the "TCAS SYSTEM OK"
R aural message is heard.

R (3) If not continuing with tests, close up in accordance
R with Close-Up instruction para. 3.V. at the end of
R the System Test procedure.

R L. Test of TCAS and ADC 1/2 Link (Ref. Fig. 506 and 509A/B)

R (1) Follow instructions in para. H.1 parts (a) to (b)
R if not continuing directly on from preceding para.

R (2) Open the following circuit breaker:

R
R
R
R
R
R

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADC1 115V SUP	2-213	1F 73	F 3

R (a) On the Captain's VSI/TCAS indicator, check that:

R - V/S Flag appears in the upper left corner.

R - Vertical speed pointer disappears.

R (3) Close ADC1 circuit breaker (Ref. Fig. 509B). Check
R that initial indications come into view on the
R VSI/TCAS indicators (V/S flag disappears and vertical
R speed pointer appears).

R (4) Repeat para. 2.(a) and 3 for the First Officers'
R indicator with ADC2 115V SUP, (Panel 13-216, CB No.
R 2F73, Map Ref. F15) pulled and reset.

R (5) Push the TEST switch on the front panel of the TCAS
R computer.

R - Make sure the aural "TCAS SYSTEM TEST OK"
R annunciation is heard.

R (6) If not continuing with tests, close up in accordance
R with Close-Up instruction para. 3.V. at the end of
R the System Test procedure.

M. TCAS Processor Failure Test

(1) Follow instructions in para. H.1 parts (a) to (f) if not continuing directly on from preceding para.

(2) Trip the TCAS System Circuit Breaker S86 at Map Ref. D4 on the Panel 13-214 and check that both VSI TCAS indicators indicate TCAS FAIL.

(3) Reset the TCAS System Circuit Breaker S86 and check the system returns to normal.

(4) Conduct an extended self test and check that "TCAS SYSTEM TEST OK" is heard.

(5) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

N. Transponder Failure Test

(1) Follow instructions in para. H.1 parts (a) and (f) if not continuing directly on from preceding para.

(2) Trip the transponder No.1 CB, S13 at Map Ref. G20 on panel 2-213 and check that both VSI TCAS indicators indicate TCAS Fail.

(3) Reset transponder No.1 CB, S13 and check that the TCAS Fail message on the VSI TCAS indicators disappears.

(4) Set XPDR selector switch on the control panel to position 2.

(5) Trip the transponder No.2 CB, S14 at Map Ref. F7 on panel 13-216 and check that both VSI TCAS indicators indicate TCAS Fail.

(6) Reset transponder No.2 CB and check that the TCAS fail message on the VSI TCAS indicators disappears.

(7) Conduct an extended self test and check that "TCAS SYSTEM TEST OK" is heard.

(8) Set XPDR selector switch on the control panel to position 1.

(9) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

O. Intruder Bearing Check on Upper TCAS Antenna

(1) Follow instructions in para. H.1 parts (a) to (f) if not continuing directly on from preceding para. N.

(2) Set up IFR TCAS-201 test set and directional (flat plate) antenna on dock or staging approx. 20 ft from the aircraft top TCAS antenna forward of the aircraft at 45 degrees off the centre line to send signals to the TCAS directional antenna.

CAUTION: DO NOT OPERATE THE TEST SET WHEN TEST SET ANTENNA IS WITHIN 15 INCHES (381 MM) OF AIRCRAFT ANTENNA AS DAMAGE TO THE TEST SET MAY OCCUR.

NOTE: Make sure there is no obstruction between the TCAS antenna and test set antenna. Face the test set antenna so that the TCAS antenna under test receives the strongest signal. Use the antenna stand to prevent movements to the test set antenna which can cause TCAS to lose tracking. If ground equipment, walkways or other objects cause a signal obstruction or a multipath problem, choose a more suitable location for the test set and change the set-up in the test set accordingly.

(3) On IFR TCAS 201 test set:

Select SET UP Menu and using the SELECT and SLEW keys configure as follows:

UUT DIST:HORIZ	:	20 ft
VERT	:	(As required for location)
INTRUDER TYPE	:	ATCRBS
ALT REPORTING	:	ON
ANTENNA GAIN	:	(shown on test set)
ANTENNA LOSS	:	(shown on the test set cable)

(4) Ensure that the fifth generator switch X219 is switched to ISOLATE. Ensure that the aircraft is in air mode by tripping the LH and RH UC WEIGHT AND DOWNLOCK Circuit Breakers (Map Ref. B8, on panel 3-213 & Map Ref. M18, on panel 1-213).

(5) Set A/C pressure altitude at 250 ft MSL at 1013.2 mb (29.92 in) Baro Setting on the selected ADC for the selected transponder altitude source. Set Radio Altitude to 250 ft.

<u>NOTE</u>: Barometric altitude can be simulated by either the mechanical apparatus or via the electrical Cruzet test set input to the ADCs. If the Cruzet test set is used, this will only plug into one ADC and thus only the equipment associated with that ADC will operate correctly. Generally, the choice for one sided operations will be ADC 1 as the ADC 1 ON/OFF switch is used to activate several functions such as the TCAS aurals and ADC amplifier Mach 1-RA inhibit signal.

(6) On IFR TCAS 201 test set press SCEN key and set the following parameters using the SELECT and SLEW keys:

RANGE =	3 NM	RATE =	0 kt
ALT =	600 ft	RATE =	0 ft/min

Press RUN key

(7) Verify that traffic is displayed on the VSI/TCAS indicator simulating traffic at approx. 3 NM and the approx. bearing of the test set to the antenna.

<u>NOTE</u>: Targets of opportunity i.e. overflying aircraft, may be displayed in addition to the simulated target. TA ONLY should be annunciated on the VSI TCAS indicators as the Concorde is on the ground below 900 ft radio height.

(8) Initiate a TCAS System Self Test by momentarily depressing the TEST button on the ATC/TCAS control panel.

(9) Verify that TEST is annunciated on the VSI TCAS indicators.

(10) Relocate the IFR TCAS 201 test set to another quadrant and again check the range and bearing of the simulated target are displayed on the IVSI's in relation to this new position.

(11) Repeat this check for locations in all 4 quadrants and verify that bearing accuracy is of the order of ± 15 deg.

(12) Reselect SET-UP on the test set and alter INTRUDER TYPE to MODE S.

R (13) Repeat the above paras (6) to (11) for this Mode S scenario.

R (14) Conduct bottom antenna bearing check as described in para. 3.P.

R (15) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

R P. Bottom Directional Antenna Bearing Check

R NOTE: In the following bottom antenna test, a barometric altitude of 10,000 ft is chosen to avoid possible interference with other aircraft. If any tests are to be conducted where the ADC input is at lower simulated altitudes, then it is possible that TCAS equipped aircraft approaching the airport will receive the transmissions and produce traffic alerts or resolution advisories. In any such TCAS system tests, if an ECCOSORBAN79 mat is not used to cover the transponder antennae (white front surface on the antenna), then the Control Tower will need to be notified to inform them that testing is taking place.

R (1) Relocate the IFR TCAS 201 test set under the A/C, approximately 15 ft (4.572 m) from the bottom directional antenna. It is desirable for the A/C to be clear of its underside docking in order to provide a clear path between the test set antenna and the bottom directional antenna.

R NOTE: At this distance the A/C structure should adequately shield the test set signals from reaching the top antenna so that any presentations on the IVSI's should be as a result of the simulated targets received by the bottom directional antenna. The situation can be assisted by placing an ECCOSORBAN79 mat (white face outward) over the top TCAS directional antenna.

R (2) Follow instructions in para. H.1 parts (a) to (f) if not continuing directly on from preceding para. Simulate a pressure altitude of 10,000 ft and simulate radio altitude at full scale.

R NOTE: The bottom antenna is switched out below 400 ft for non Mode S replies.

R (3) Configure the IFR TCAS 201 test set to simulate an intruder at an altitude of 9500 ft, distance of 5 NM and closure rate of 0 Kts. Press RUN key.

R (4) Verify the reasonableness of the displayed intruder range and bearing as the test antenna is moved slowly around the bottom directional antenna at constant distance.

R NOTE: A typical bearing accuracy of ± 15 deg. can be expected but may be influenced by reflections and multipath signals from surrounding structure. If difficulty is experienced, this check should be conducted with the A/C positioned outside and away from obstructions.

R (5) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

R Q. TCAS Response Tests

R (1) Scenario 1 - Traffic Alerts.

R (a) Follow instructions in para. 3.G. if not continuing directly on from preceding para. 3.P.

R (b) On ATC/TCAS control unit, set the selector switches to the following positions:

R
- STBY-XPDR-TA-RA/TA to STBY position.
- XPDR 1/2 selector switch to 1.
- On the VSI/TCAS indicators, select 16 NM range.
- Check that there is no display on the VSI/TCAS indicators.
- Check that "TCAS OFF" flag is displayed on VSI/TCAS indicators.
- Check that "TCAS FAIL" message is not displayed.

R R (c) Ensure that the NORMAL/ISOLATE switch X219 is at ISOLATE, then open following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH UC WEIGHT SW "A" SYS SUP	1-213	G295	M18
LH UC WEIGHT SW "B" SYS SUP	3-213	G293	B 8

(d) Simulate full scale on radio altimeters 1 and/or 2 starting from 0 ft with the radio altimeter test set (Ref. 34-42-00, Adjustment/ Test).

(e) With ADC1 and ADC2 in operation, simulate 10,000 ft pressure altitude on altimeter 1 and/or 2 (Ref. para. 0.5 - Intruder Bearing Check).

(f) On IFR TCAS 201 test set, select the set up and SCEN keys and insert the following data:

- Intruder Type : ATCRBS
- Range : 5 NM
- Range Rate : +250 kts
- Altitude : 9900 ft
- Altitude Rate : 0 ft/min.

NOTE: The IFR TCAS 201 test set omnidirectional antenna (whip) may be used in this test as bearing accuracy is not under scrutiny. Also, the test set may be positioned either above or below the aircraft. The Set/Cont key must be pressed on the TCAS 201 tester in order to set up the following parameters: UUT horizontal distance, vertical distance, antenna gain and loss, altitude reporting: On and Intruder type.

(g) Run the scenario:

- On ATC/TCAS control unit, place selector switch in TA ONLY position.

- Press the RUN/STOP key on the IFR TCAS 201 test set to run the scenario.

- Check that intruder symbol appears:

  Proximate symbol ◇ becomes TA ○

- "TA ONLY" is displayed on white background.
- "TRAFFIC, TRAFFIC" vocal message is heard when white background of TA ONLY message becomes yellow.
- Check that intruder symbol approaches the aircraft, that it does not become an RA symbol and that there is no resolution advisory displayed.
- When the intruder approaches the aircraft and then turns back, stop the scenario.

NOTE: The relative altitude shown can be -00 or -01 depending on your actual vertical separation. This is because TCAS can only display relative altitude by 100 ft increments. A change of the aircraft's altitude or intruder set-up on the test set can be made to achieve the required altitude display.

(h) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

(2) Scenario 2 - Resolution Advisories

(a) Follow instructions in para. Q.1 parts (a) to (e) (Scenario 1 - Traffic Alerts) if not continuing directly on from preceding para.

(b) On IFR TCAS 201 test set press SCEN key and set the following parameters using the SELECT and SLEW keys:

- Intruder type : MODE S
- Range : 18 NM
- Range rate : +250 kts
- Altitude : 12700 ft (Intruder descends down to 9900 ft)
- Altitude rate : 700 ft/min

(c) On control unit, place selector switch in RA/TA position and start the scenario.

(d) Check that "TA ONLY" message does not appear on the VSI/TCAS indicators.

(e) Press the RUN/STOP key on test set and check that the intruder symbol changes as it approaches the aircraft horizontally and vertically.

(f) Check that at the end of the intruder approach the intruder symbol becomes RA (■) and a CLIMB CLIMB vocal message is generated.

<u>NOTE</u>: Key to intruder symbols and meanings:

(◇) OTHER - empty blue diamond: Intruder aircraft : altitude comprised between +/- 2700 ft and max. range is 16 NM.

(◆) PROXIMATE - full blue diamond: Intruder aircraft : altitude from 1200 ft and range from 6 NM.

(●) TA - full amber/yellow circle (Traffic advisory) + generation of "TRAFFIC TRAFFIC" vocal message.

(■) RA - red square (Resolution Advisory) Traffic and Resolution Advisory intruders : altitude < +850 ft and range < 6 NM.

(g) Stop the scenario.

(h) If not continuing with tests, close up in accordance with Close-Up instruction Section 3.V. at the end of the System Test procedure.

(3) Scenario No. 3 - Flight Level Switch Test.

(a) Follow instructions in para. Q.1. parts (a) to (d) (Scenario 1 - Traffic Alerts) if not continuing directly on from preceding para.

(b) With ADC1 and ADC2 in operation, simulate 20,000 ft pressure altitude on altimeter 1 and/or 2 (Ref. para. O.5. - Intruder Bearing Check).

(c) On IFR TCAS 201 test set press SCEN key and set the following parameters using the SELECT and SLEW keys:

- range : 12 NM
- range rate : 0 kts
- altitude : 20,000 ft
- altitude rate : 0 ft/min

(d) On ATC/TCAS control unit, place STBY-XPDR-TA-RA/TA switch in RA/TA position.

(e) Press the RUN/STOP key on the test set to run the scenario and on the control unit, press the F/L pushbutton switch.

- Check that the flag FL is displayed in centre right window on the VSI/TCAS indicators.
- Check that the intruder is displayed with information of barometric altitude placed above or below.
- Check that the information of barometric altitude is displayed with three digits representing hundreds of feet.
- Verify that barometric altitude is displayed for each pilot selection (switch F/L) only for approximately 15 seconds.
- Verify that the relative altitude is displayed after 15 seconds.

(f) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

(4) Scenario 4 - Check of the BELOW and ABOVE functions.

(a) BELOW function.

(a1) Follow instructions in para. Q.1 parts (a) to (d) (Scenario 1 - Traffic Alerts) if not continuing directly on from preceding para.

(a2) With ADC1 and ADC2 in operation, simulate 11,000 ft pressure altitude on altimeter 1 and/or 2 (Ref. para. O.5. - Intruder Bearing Check).

(a3) On IFR TCAS 201 test set press SCEN key and set the following parameters using the SELECT and SLEW keys:

- Type of intruder : ATCRBS
- Range : 2 NM
- Range rate : 0 kts
- Altitude : 4,000 ft
- Altitude rate : 0 ft/min

(a4) On control unit, place the A-N-B selector switch in B position and place STBY-XPDR-TA-RA/TA in RA/TA position.

(a5) Start the scenario by pressing the RUN/STOP key on the test set.

- Check that the OTHER symbol and the -70 relative altitude are displayed on the VSI/TCAS indicators.

(a6) Decrease the intruder altitude on the test set down to 3,800 ft and running the scenario, check that the intruder disappears from the VSI/TCAS indicators.

(b) ABOVE function.

(b1) On IFR TCAS 201 test set press SCEN key and set the following parameters using the SELECT and SLEW keys:

- Type of intruder : ATCRBS
- Range : 2 NM
- Range rate : 0 kts
- Altitude : 18,000 ft
- Altitude rate : 0 ft/min

(b2) On the control unit, place the A-N-B switch in the A position.

(b3) Start the scenario.

On the IVSI/TCAS indicators check that the OTHER intruder appears with a relative altitude of +70.

(b4) Increase the altitude of the intruder up to 18,200 ft and check that it disappears from the IVSI/TCAS indicators.

R (b5) On the control unit, place the A-N-B selector switch in N position.

R (b6) Stop the scenario.

R (b7) If not continuing with tests, close up in accordance with Close-Up instruction para. V. at the end of the System Test procedure.

R (5) Scenario 5 - Inhibition of RA messages.

R (a) Follow instructions in para. Q.1 parts (a) to (c) (Scenario 1 - Traffic Alerts) if not continuing directly on from preceding para.

R (b) Adjust the altimeters to 1013 (mb/hPa).

R (c) On the ATC/TCAS control unit, place the selector STBY-XPDR-TA-RA/TA switch in RA/TA position.

R (d) On TCAS 201 test set press SCEN key and set the following parameters using the SELECT and SLEW keys:

R
- Type of intruder : ATCRBS
- Range : 5 NM
- Range rate : 250 kts
- Altitude : 2,100 ft
- Altitude rate : 0 ft/min

R (e) Check for no inhibition of RAs and TAs above 1,450 ft.

R
- Simulate 2,000 ft on the altimeters.
- Simulate 1,600 ft on the radio altimeters.
- Start the scenario and check that:

R
  - The intruder symbol changes.
  - The vocal message is "TRAFFIC, TRAFFIC" as soon as the symbol turns to TA then to RA and the following vocal messages are successively generated:

R
"DESCEND, DESCEND, DESCEND"
"INCREASE DESCENT", "INCREASE DESCENT"
"CLEAR OF CONFLICT".

R (f) Check for inhibition of the "INCREASE DESCENT"
R below 1,450 ft as follows:

R - Simulate 1,300 ft on the radio altimeter.
R - Start the scenario and make certain that the
R symbols change from TA to RA and that the
R following vocal messages are generated
R "TRAFFIC, TRAFFIC", "DESCEND, DESCEND,
R DESCEND".
R - Continue until the "CLEAR OF CONFLICT" aural
R message is generated.
R - Ensure that the aural message:
R "INCREASE DESCENT"
R "INCREASE DESCENT" is inhibited.

R (g) Check for inhibition of RA "DESCEND" if the
R aircraft is descending below 1,000 ft as follows:

R - Set the radio altimeter initially to 1,300 ft
R and then descend to 910 ft when the scenario
R starts.

R - Check that the TA only flag is not displayed
R on the VSI TCAS indicators.

R - Start the scenario and check that the symbols
R change into TA, RA and that the vocal messages
R are generated:

R - "TRAFFIC, TRAFFIC".

R - Ensure that the vocal message:

R - "DESCEND, DESCEND, DESCEND" is inhibited.

R - Disregard all the other messages during this
R test ("CLIMB" or "INCREASE CLIMB").

R (h) Check the inhibition of RA symbols and aurals and
R TA vocal messages below 900 ft as the aircraft is
R descending.

R - Set the radio altimeter initially to 910 ft.

R - Descend down to 800 ft.

R - Check that the "TA ONLY" flag is visible on
R the VSI/TCAS indicators.

- Run the scenario by pressing the RUN/STOP key on the test set and check that the symbols change to TA and that the "TA ONLY" flag changes from white to yellow.
- Check that all RA symbols and aurals and TA vocal messages are inhibited.

(j) Check the RA "DESCEND" is inhibited below 1200 ft when the aircraft is ascending.

- Close the following circuit breakers to put the aircraft in ground mode:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH UC WEIGHT SW "A" SYS SUP	1-213	G295	M18
LH UC WEIGHT SW "B" SYS SUP	3-213	G293	B 8

- Set the radio altimeter to 0 ft.
- Return the aircraft to the air mode by tripping the CBs.
- Set radio altimeter to 800 ft.
- Start the scenario:
- Check that the TA symbol is obtained with the vocal message "TRAFFIC, TRAFFIC".
- Make certain the message "DESCEND, DESCEND, DESCEND" is not heard during the scenario.
- Disregard the other vocal messages during the test.

(k) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

R. Inhibition with respect to the Mach Speed

(1) Follow instructions in para. Q.1 parts (a) to (b) (Scenario 1 - Traffic Alerts) if not continuing directly on from preceding para.

- Ensure that:
  - ADC1 is on
  - INSs operating
  - Radio altimeters 1 and 2 are set to full-scale.

(2) Increase altitude and speed on machmeter and altimeter using the Cruzet test set on ADC No.1.

(3) Check that:

- When the mach speed increases, the inhibition occurs for M > 1.01 + 0.01 and TA ONLY is displayed on the VSI/TCAS indicators.

- When the mach speed decreases, the inhibition is removed for M < 0.99 + 0.01 the TA ONLY flag disappears from the VSI/TCAS indicators.

(4) If not continuing with tests, close up in accordance with Close-Up instruction para. 3.V. at the end of the System Test procedure.

S. Inhibition of the TCAS Warning by GPWS warning

(1) Follow instructions in para. Q.1 parts (a) and (b) (Scenario 1 - Traffic Alerts) if not continuing directly on from preceding para.

(2) On the ATC/TCAS control unit, press and release the TEST pushbutton switch:

(a) After initiation of the self-test, press the GPWS TERRAIN pushbutton switch (5 seconds).

(b) Ensure that the TCAS aural warnings stop or are not generated and that the GPWS aural warnings are generated:

"PULL UP, PULL UP"

TA ONLY is displayed (white background) on VSI/TCAS indicators.

R (4) If not continuing with tests, close up in accordance
R with Close-Up instruction para. 3.V. at the end of
R the System Test procedure.

R T. Inhibition of the TCAS Warning by the Stall Warning

R (1) Follow instructions in para. Q.1 parts (a) and (b)
R (Scenario 1 - Traffic Alerts) if not continuing
R directly on from preceding para.

R (2) On the ATC/TCAS control unit, place STBY-XPDR-TA-RA/TA
R selector switch in RA/TA position.

R (3) Press the TEST pushbutton switch and check for TCAS
R Test OK message.

R (4) Manually place the alpha probe at the maximum stop
R position (< 16.5).

R (5) Press the TCAS Test pushbutton and check that no TCAS
R aural message is produced and TA ONLY is displayed on
R the VSI/TCAS indicators (white background).

R - Aural warning: alpha probe + stick shaker.

R (6) If not continuing with tests, close up in accordance
R with Close-Up instruction para. 3.V. at the end of
R the System Test procedure.

R U. Inhibition of the TCAS warning by the AUDIO CANCEL

R (1) Ensure that preparation for System Test requirements
R in para. 3.G. have been performed if not continuing
R directly on from the preceding section.

R (2) Initiate a TCAS self-test by pressing the TEST
R pushbutton switch on the ATC/TCAS control unit.

R (3) After one second, press one of the AUDIO CANCEL
R pushbutton switches.

R - Check that no TCAS aural is heard.

R V. Close-Up

R (1) On ATC/TCAS control unit, place: ALT RPTG-OFF
R selector switch in ALT RPTG 1 or 2 position and
R STBY-XPDR-TA-RA/TA selector switch in STBY position.

R (2) Turn off the ADCs and INS.

(3) Close the following circuit breakers to put the aircraft in ground mode:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH UC WEIGHT SW "A" SYS SUP	1-213	G295	M18
LH UC WEIGHT SW "B" SYS SUP	3-213	G293	B 8

Trip the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X355	H 2
NAV INST BUS 13X	13-216	G345	G 4

(4) Shut down and remove any test equipment.

(5) Place the emergency generator NORMAL/ISOLATE switch to NORMAL.

(6) Shut down electronics rack ventilation (Ref. 21-21-00).

WARNING: ENSURE THAT NO WARNING CODES (7500, 7600 OR 7700) REMAIN DISPLAYED ON ATC/TCAS CONTROL UNIT.

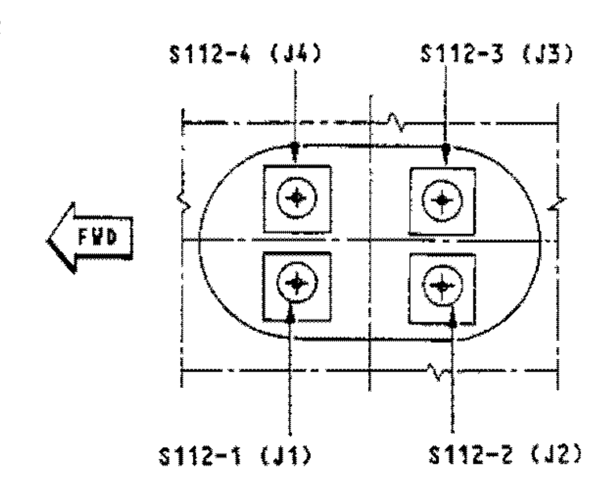
PRINTED IN ENGLAND

INTENTIONALLY BLANK

UPPER

COLOUR CODE CHART

CONNECTOR	SLEEVE
S112-1 (J1)	YELLOW
S112-2 (J2)	BLACK
S112-3 (J3)	BLUE
S112-4 (J4)	RED



LOWER

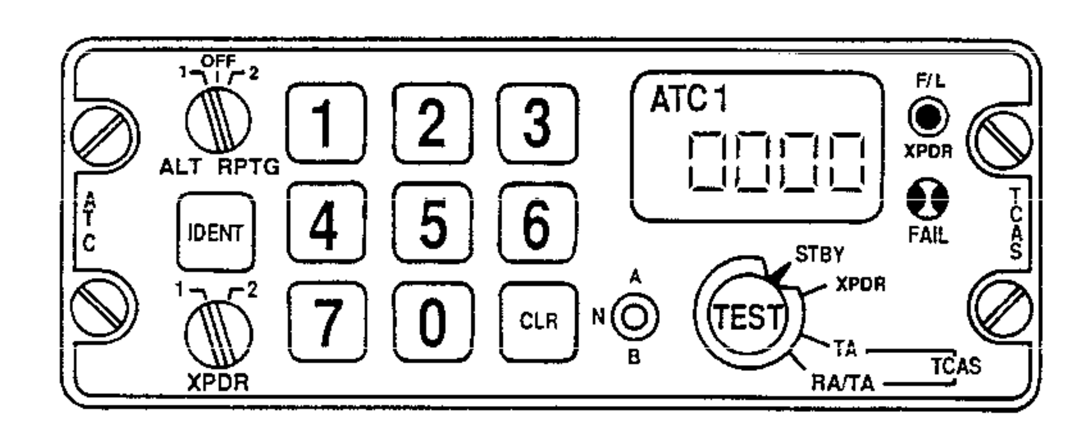
COLOUR CODE CHART

CONNECTOR	SLEEVE
S111-1(J1)	YELLOW
S111-2(J2)	BLACK
S111-3(J3)	BLUE
S111-4(J4)	RED

S111-4 (J4)
S111-3 (J3)
FWD
S111-1 (J1)
S111-2 (J2)

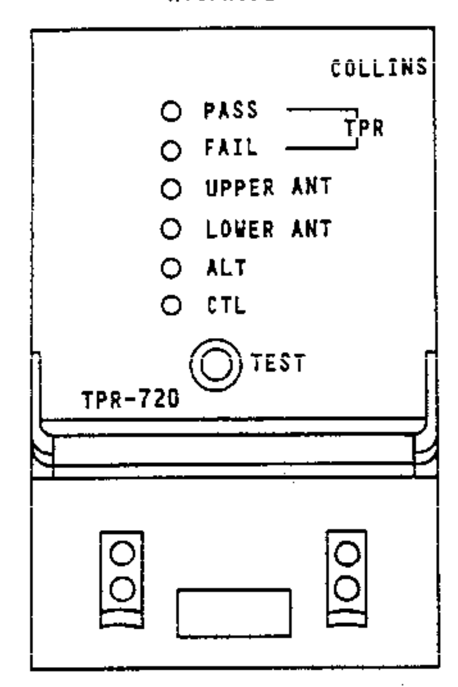
34 43 00 501A

TCAS - Antennae
Figure 501



ATC/TCAS Control Unit
Figure 502

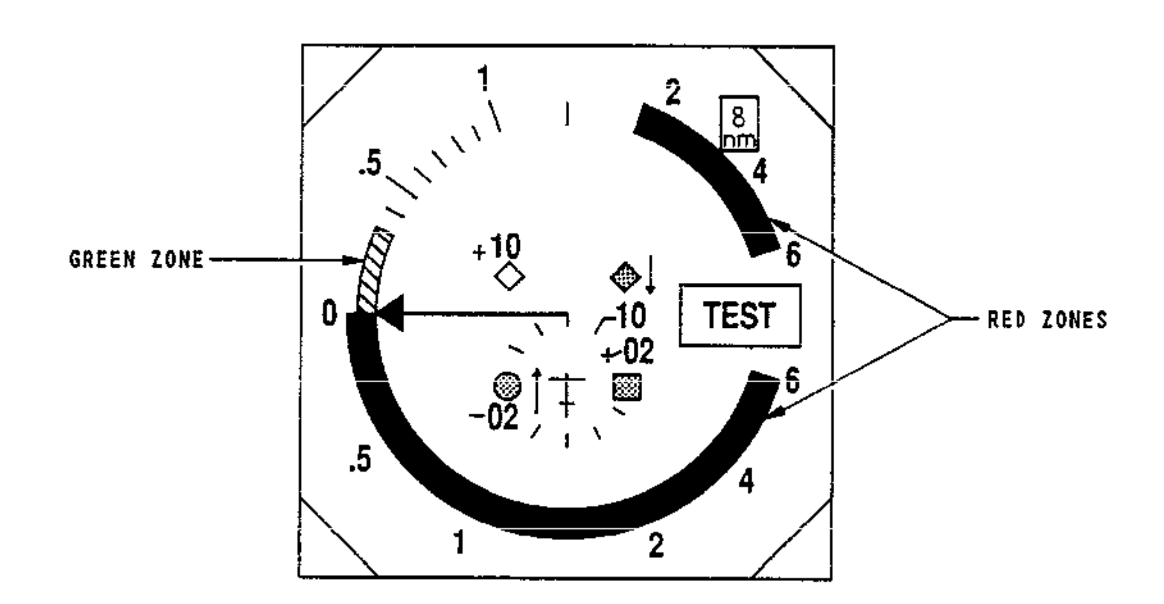
ATC/MODE S



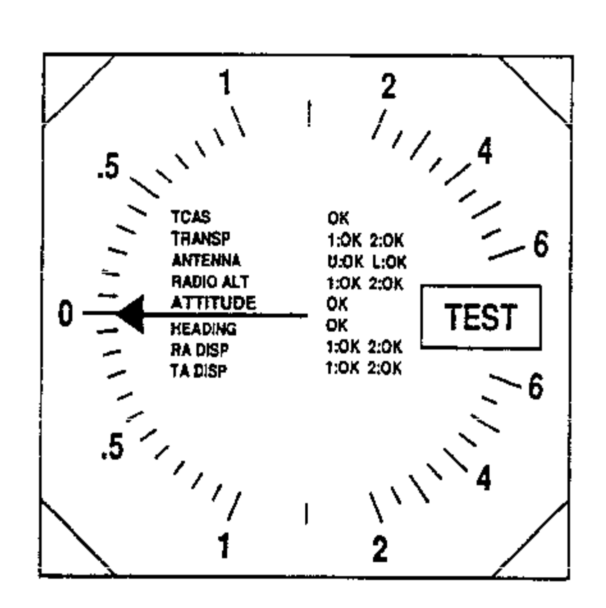
TCAS

PASS
FAIL
TTR
X PDR
UPPER ANT
LOWER ANT
RAD ALT
HDNG
R/A
T/A
TEST
TTR-920

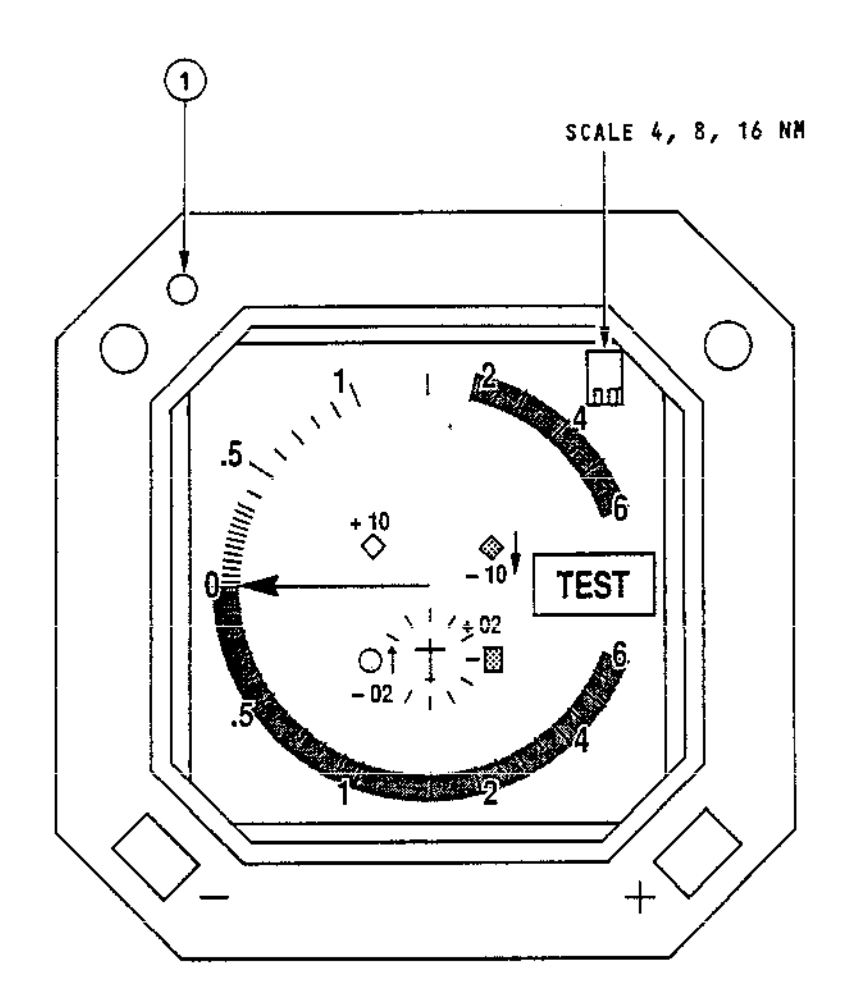
Front ATC Mode S and TCAS
Figure 503



VSI/TCAS Indicators (First and Second Instance)
Figure 504

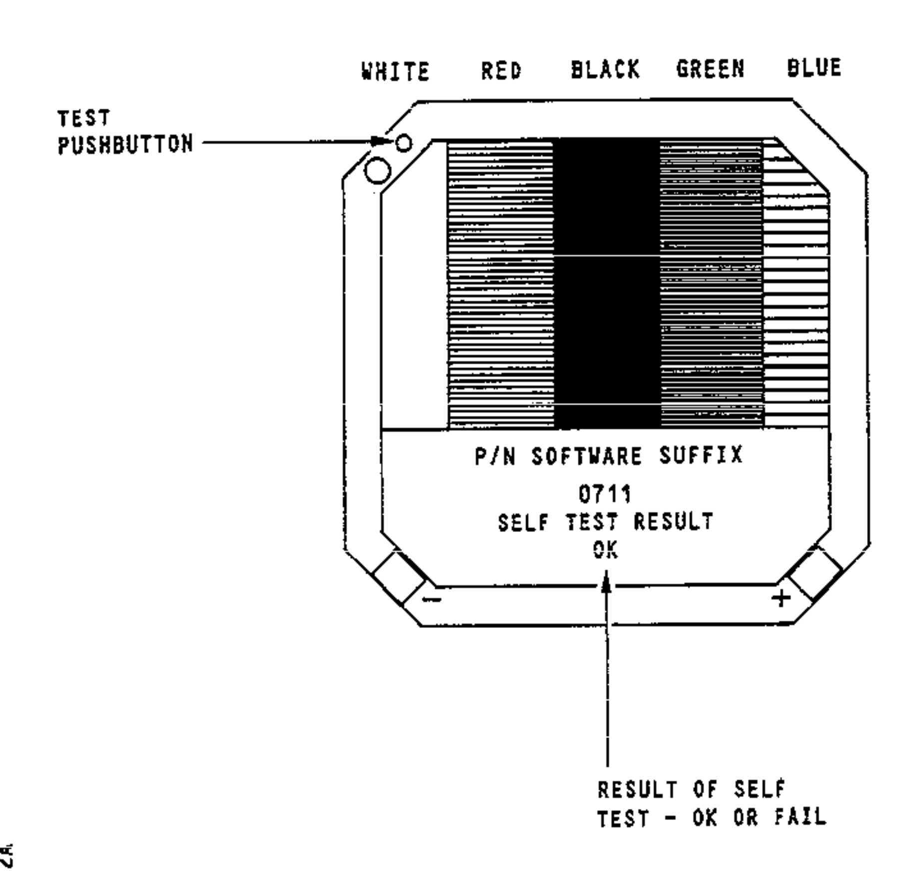


VSI/TCAS Indicators (Third Instance)
Figure 505



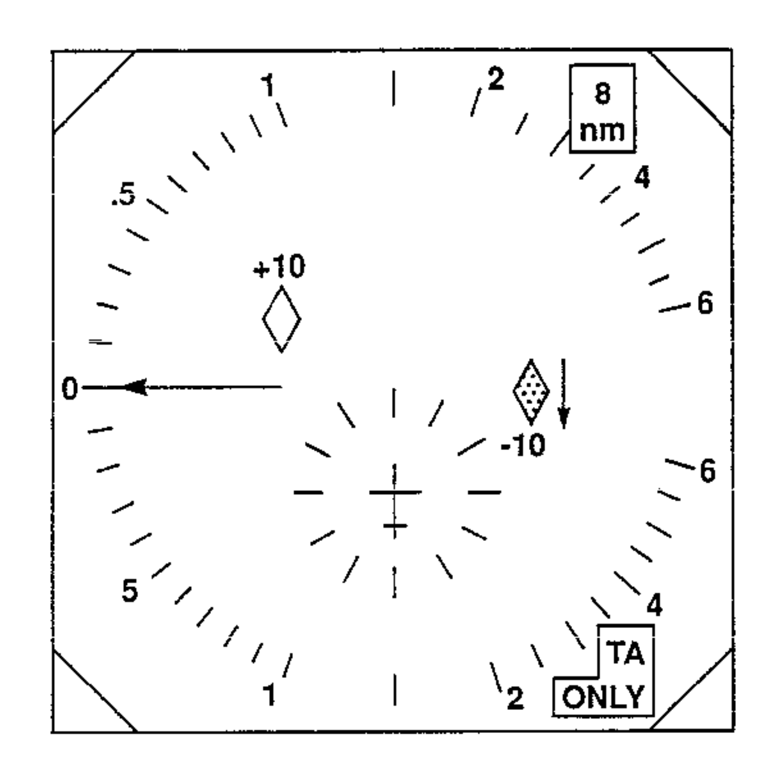
34 00 00 506A

VSI/TCAS Indicators - (Self Test)
Figure 506



34 43 00 102A

VSI/TCAS Indicators - (Self Test)
Figure 507

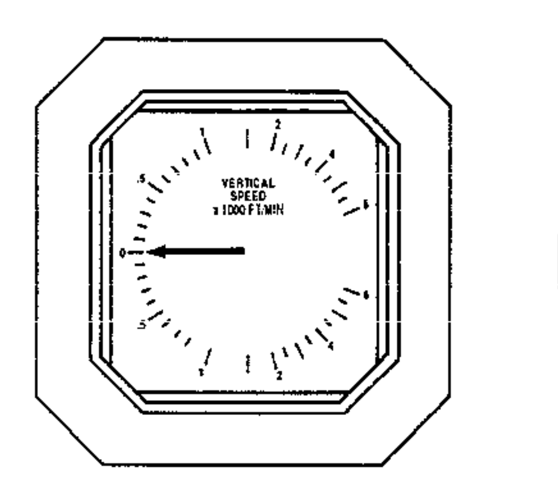


34 43 00 508A

VSI/TCAS Indicators (TA Only)
Figure 508

V/S
VERTICAL
SPEED
x 1000 FT/MIN

A



34 43 00 509A

VSI/TCAS Indicators (TCAS and ADC 1/2 Link)
Figure 509

END OF THIS SECTION

NEXT

TCAS ANTENNA - REMOVAL/INSTALLATION

1. General

This procedure is for replacement or check. The TCAS system uses two antennae, one antenna on the lower surface of the aircraft (S111) between frames 9 and 10, and an antenna on the upper surface of the aircraft (S112) between frames 9 and 10. The two antennae are identical.

2. TCAS Antenna

A. Equipment and Materials

		DESCRIPTION	PART NO.
RB		Sealant (Between antenna & clamp ring	DC730RTV
RB		Sealant (Around clamp ring)	PR1829B1-2SEMK1T
RB		Primer	PR186
RB		'O' Ring	830-4924-001
		Blanking stowage	E22.5103.000
RB		Calibrated Torque Screwdriver	016200
RB		Degreasing Agent	Isopropyl Alcohol
RB		Bonding tester	-
		Circuit Breaker Safety Clips	-
	(*)	Access platform, height of access 3,672 m (12 ft)	-
	(**)	Access platform, height of access 6,670 m (21 ft 11 in)	-

B. Prepare

(1) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC 1 MODE S	2-213	S13	G20
ATC 2 MODE S	13-216	S14	F 7
VSI/TCAS CO-PILOT	13-216	S96	F 8
VSI/TCAS PILOT	13-215	S95	E 4
TCAS	13-215	S86	D 4

(2) Place access platform.

(a) (*) under lower TCAS antenna in zone 123.

(b) (**) level with upper TCAS antenna in zone 215.

C. Remove (Ref. Figs. 401, 402)

(1) Loosen, remove and retain the 16 mounting screws (1) for upper antenna (S112) or the 14 mounting screws for lower antenna (S111) while manually supporting antenna (4) and clamp ring (3).

RB (2) Remove and retain clamp ring (3). Ensure that the
RB clamp ring is identified as upper or lower and the
RB forward end is indicated. Remove antenna from its aperture until access can be gained to co-axial connectors.

RB (3) Disconnect aircraft co-axial connectors from antenna connectors.

(4) Remove gasket (5) and sealant from aircraft skin. Discard gasket.

(5) Remove sealant from clamp ring (3) and clean antenna mounting area on fuselage.

D. Preparation of Replacement Component

(1) Ensure that antenna is in good external condition and particularly that connector has no trace of corrosion.

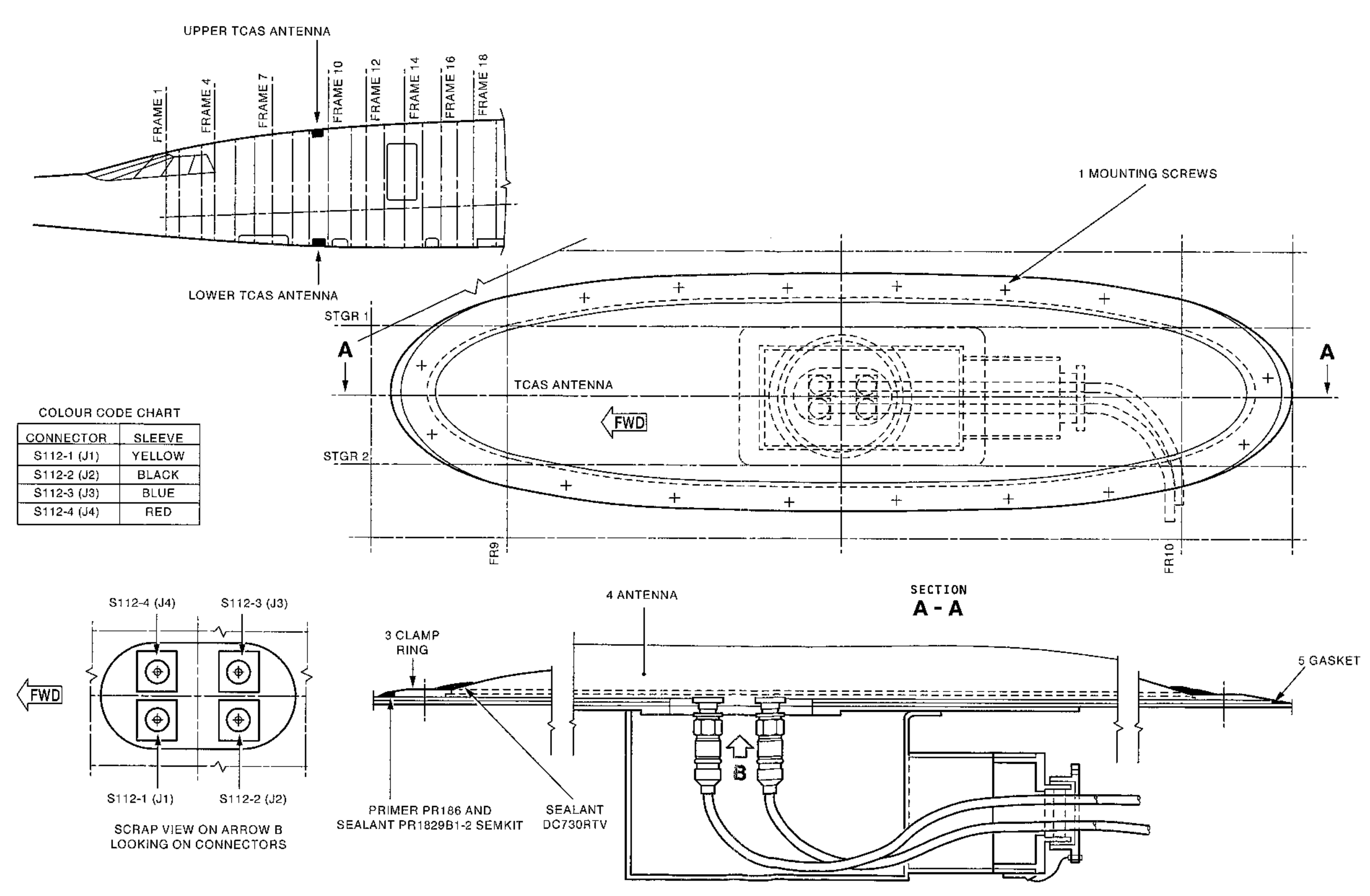
E. Install (Ref. Figs. 401, 402)

(1) Ensure all traces of old sealant have been removed from the antenna aperture, surrounding area of fuselage and clamp ring (3).

(2) Clean countersunk surface of clamp ring mounting screw holes and underside of fixing bolt heads (Ref. 20-27-11).

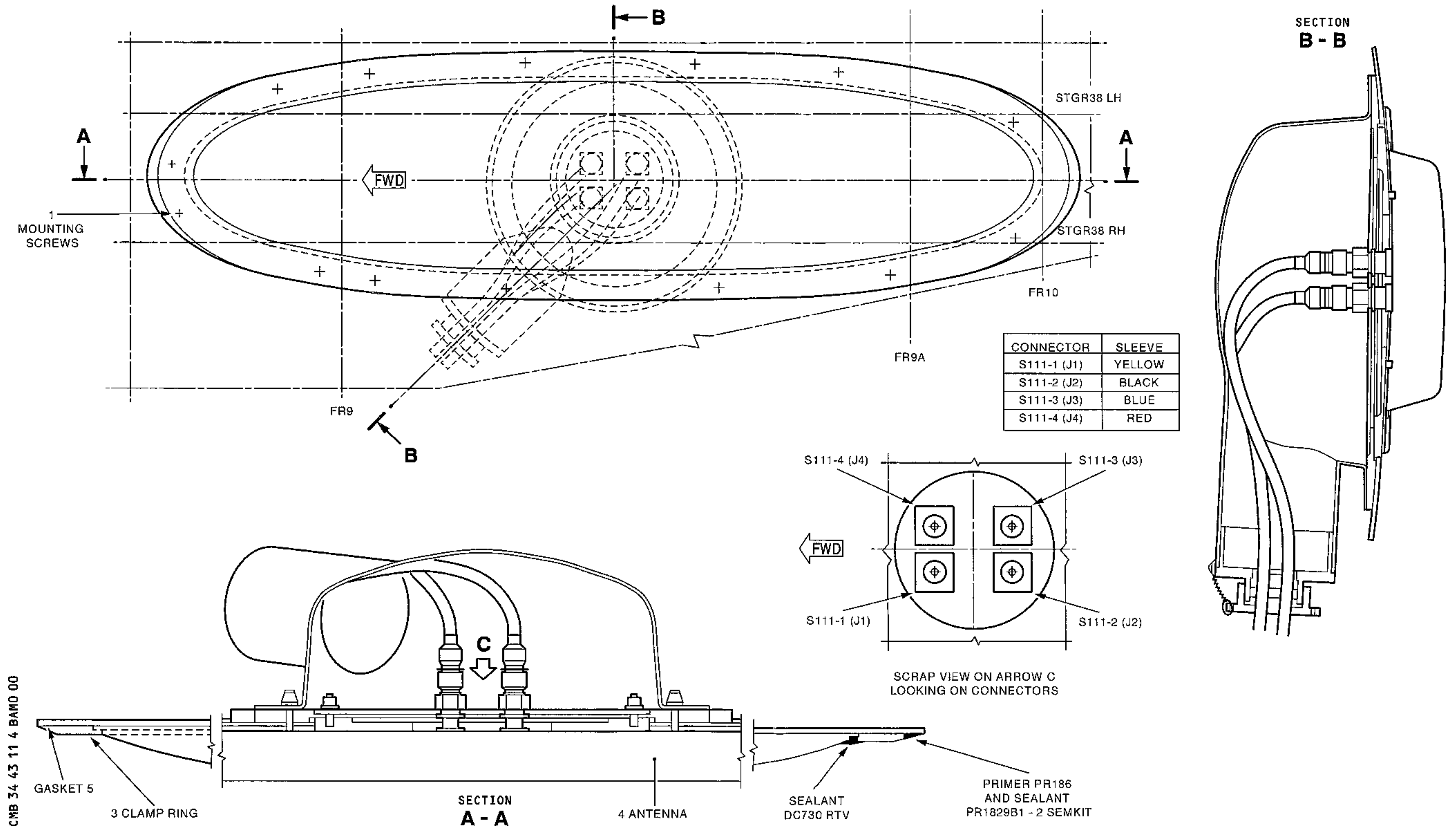
RB (3) Ensure that any nicks in the aluminium clamp ring (3)
RB are treated with Alocrom (Ref. 20-24-32).

RB (4) Lay clamp ring (3) in position on new antenna gasket (5). Mark and cut positions of clamp ring mounting screw holes on gasket as described in operation (5).



CONNECTOR	SLEEVE
S112-1 (J1)	YELLOW
S112-2 (J2)	BLACK
S112-3 (J3)	BLUE
S112-4 (J4)	RED

Upper TCAS Antenna - Removal/Installation
Figure 401



CONNECTOR	SLEEVE
S111-1 (J1)	YELLOW
S111-2 (J2)	BLACK
S111-3 (J3)	BLUE
S111-4 (J4)	RED

Lower TCAS Antenna - Removal/Installation
Figure 402

(5) Prepare the gasket (5) as follows:

WARNING: THE EDGES OF THE GEL GASKET ARE VERY SHARP SO CARE MUST BE TAKEN IN HANDLING THE GASKET.

(a) Place a gel gasket complete with protective mylar covers centrally on the underside of the clamp ring (3). (The gasket is cut slightly smaller than the periphery of the clamp ring for gel squeeze out when the antenna is clamped down). If the protective covers are oversize, trim the covers to the shape of the gasket.

(b) At the front end of the clamp ring (3), select one of the mounting screw holes and punch a locating hole through the gasket. Open this hole out to 5 mm diameter. Insert mounting screw (1) through the clamp ring (3) and gel gasket.

(c) Repeat item (b) at the other end of the clamp ring (3), making sure that the gasket remains centrally positioned.

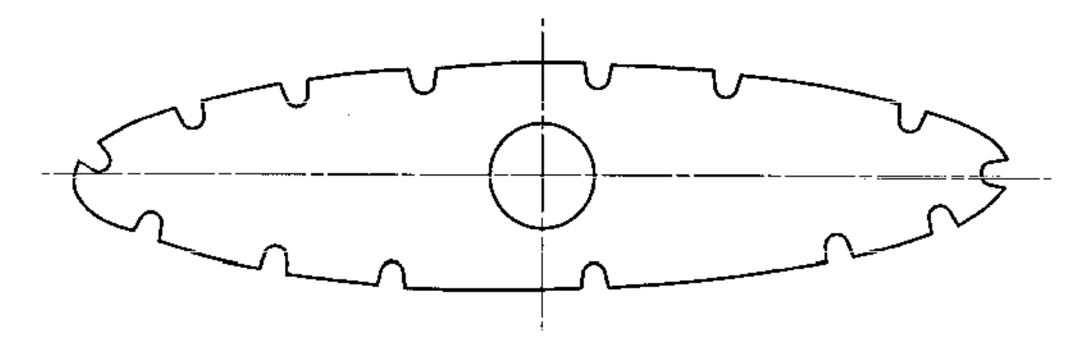
(d) Punch through all other clamp ring hole locations on the gel gasket and push through mounting screws (1) to clear excess gel and mesh.

(e) The mylar protective covers should be in 4 pieces on each side of the gasket, in which case go to (5)(f) if not, proceed as follows:

- Remove the gasket (5) from the clamp ring (3) and at the forward end peel back both mylar covers a little way to ease release of the film.
- Peel back the aircraft incident side mylar sheet to half way along the gasket.
- Cut the peeled mylar longitudinally to produce a slit running from the tip to the centre of the gasket.
- Cut out half moon sections of the mylar from the edge and around each screw hole. (This will allow the mylar sheet to be pulled away from the gel when offering up the antenna to the fuselage and clamp ring mounting screws (1) are present). (Ref. Fig. 403).

RB - Lay the cut mylar section back on the gel.
RB - Repeat the above procedure for the other half of the aircraft incident side mylar sheet and then make a cut at the centre of the mylar sheet so that the mylar sheet is then in four quarters on the gel with areas missing around the screw holes, exposing the gel. (Ref. Fig. 403).

RB (f) If the mylar protective covers are in four pieces, on the aircraft incident side of the gasket, cut off and remove half moon areas of mylar around each screw hole.



TCAS Antenna Gasket - Preparation
Figure 403

CMB 34 43 11 4 CAM0 00

RB (6) Insert the antenna into the clamp ring (3), making sure that the forward end of the antenna is located at the forward end of the clamp ring. Support the two ends of the clamp ring so that the antenna is suspended.

RB (7) Place the O-ring in the groove in the antenna base, if a new one is not already present.

RB (8) Locate the forward end of gasket onto the forward end of the clamp ring (3). On the clamp ring incident side of the gasket, peel back the mylar sheet(s) slowly while pressing the exposed gel surface onto the antenna base and clamp ring. Ensure that the holes in the gasket line up directly with holes on the clamp ring.

RB <u>CAUTION:</u> DUE TO THE BUILD UP OF MANUFACTURING TOLERANCES, CHECK THE LENGTH OF THE MOUNTING SCREWS (1) PRIOR TO TORQUE TIGHTENING.

RB (9) Insert a number of mounting screws (1) into the clamp ring (3) and offer up the antenna/clamp ring/gasket combination to the aircraft.

RB (10) Correctly attach the TCAS cables to the colour coded antenna connectors and tighten the connector nuts. (Ref. Figs. 401, 402).

RB (11) Peel off the four quarter-section mylar pieces and press the clamp ring onto the fuselage. Ensure that the coax cables are positioned so as to not cause outward pressure on the antenna base.

RB (12) Loosely screw in the clamp ring mounting screws (1).

RB (13) Using the Torque leader "Quickset" torque screwdriver and No.8 Torqueset bit, torque up the screws, in the order specified in Figure 404, initially to 20 lbf in (0.226 mdaN) and finally to between 40 and 45 lbf in (0.452 and 0.509 mdaN).

RB (14) Wipe off any excess gel with a blunt instrument and wipe the area with Isopropyl Alcohol to degrease the surface.

RB (15) Mask the antenna (4) and fuselage appropriately to protect from sealant so that a neat fillet seal will be produced between the clamp ring (3) and fuselage.

RB (16) Brush apply adhesion promoter, PR186 around the outer circumference of the clamp ring (3) at the clamp ring/fuselage interface. Allow the promoter to air dry for 30 minutes at ambient temperatures. The cured adhesion promoter should exhibit a slight gloss.

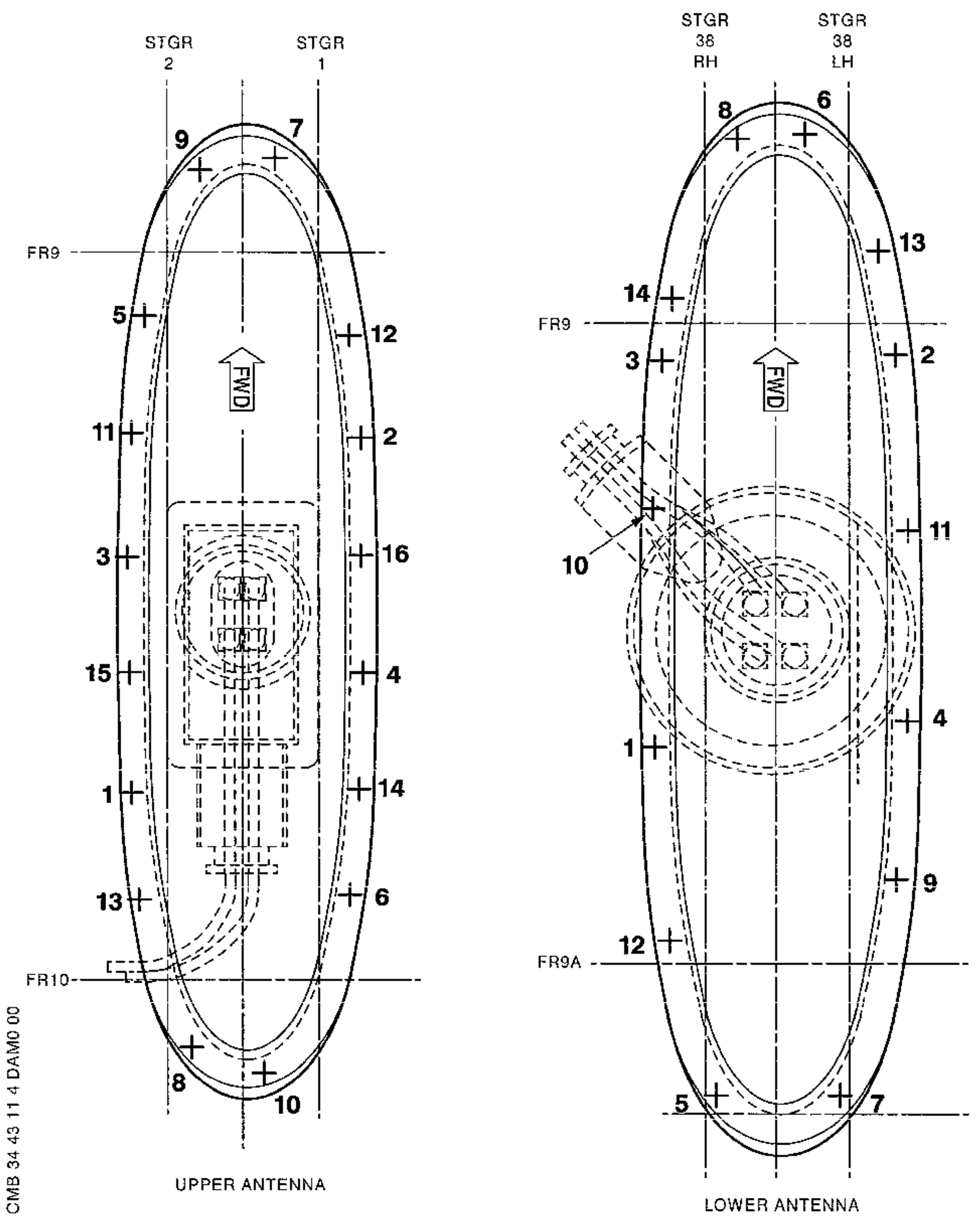
RB (17) Apply sealant PR1829 (black colour) to form an aerodynamic fillet around the clamp ring (3).

RB (18) Apply sealant DC730RTV to the gap between the antenna (4) and clamp ring (3). (No Primer required). Also smear sealant around each screw hole.

RB NOTE: PR1829B1-SEMKIT has a ½ hour work time and cures at ambient temperature (20°C) within 8 hours.
DC730RTV requires 8 hours to set and is flyable then but needs 24 hours to cure fully.

RB (19) Peel off the protective masking on the antenna (4), clamp ring (3) and fuselage.

RB NOTE: If blanking stowage is fitted in place of the antenna, the sealing is to be used as above.



TCAS Antenna - Screw Tightening Sequence
Figure 404

RB (20) Connect one terminal of a bonding tester to the structure of the aircraft in the area of the antenna.

RB (21) Using a suitable clamp device to provide the necessary cross sectional area of contact on the other terminal, pass a current of 5 ampere between each antenna mounting screw (1) and the aircraft structure. Check that voltage drop across any screw does not exceed 5 millivolts.

RB (22) If necessary, to obtain bonding, remove mounting screws (1), clean countersunk surface of the antenna attachment holes, located on the mounting flange and on the underside of the mounting screw heads (Ref. 20-27-11). Refit the mounting screws (1) and repeat the bonding test.

F. Tests

(1) Remove safety clips and tags and reset the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC 1 MODE S	2-213	S13	G20
ATC 2 MODE S	13-216	S14	F 7
VSI/TCAS, CO-PILOT	13-216	S96	F 8
VSI/TCAS, PILOT	13-215	S95	E 4
TCAS	13-215	S86	D 4

(2) Remove panel 215DS to gain access to shelf 5-215 (LH electronics rack).

(3) Switch on the electronics rack ventilation system (Ref. 21-21-00 Adjustment/Test).

(4) Carry out Prepare procedure for operational test (Ref. 34-43-00, Adjustment/Test).

(5) On centre console 9-211, on ATC/TCAS control panel place:

(a) XPDR1-2 selector switch in position 1 or 2.

(b) STBY - XPDR - TA - RA/TA switch to STBY position.

(6) On LH electronics rack, shelf 5-215, on front panel of TCAS computer, press test push-button.

(7) Carry out operational test of TCAS (Ref. 34-43-00 Adjustment/Test).

(8) Install panel 215DS on LH electronics rack.

RB G. Post Installation Pressure Test

RB (1) Supply air from two air start trucks to both left and
RB right start connections.

RB (2) Open one air conditioning group per side to supply
RB pressurizing air to aircraft.

RB (3) Carry out functional test of pressure regulating
RB system 2 (Ref. 21-35-00, Adjustment/Test, para. 2.F.).

RB NOTE: Disregard sub-para. (5) of Test. At sub-para.
RB (10) select an altitude of -5000 ft.

RB (4) When pressure stabilizes (differential pressure
RB approx. 2.5 to 3 psi) check TCAS aerial installation
RB for leaks by hand.

RB (5) After completion of leak check, proceed with
RB depressurization and shutdown (Ref. Adjustment/Test,
RB para. 2.F.).

RB H. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00, Adjustment/Test).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(3) Remove access platform(s) from working area.

TCAS/ATC MODE S CONTROL UNIT - REMOVAL/INSTALLATION

1. General

The TCAS/ATC Mode S control unit S11 is common to both the TCAS and the ATC Mode S systems. (Refer to 34-52-13).

VSI/TCAS INDICATOR (S88) - REMOVAL/INSTALLATION

1. General

The indicators are installed, on the Captain's (2-211) and First Officer's (2-212) instrument panels. The indicators may not be able to be directly withdrawn from the front of the instrument panels because of insufficient wiring length, and may necessitate Removal/Installation of other equipment.

2. Removal/Installation

NOTE: As the indicator consists of two identical modules, the connectors must be correctly identified during removal and installation.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	-
Blanking Caps for Electrical Connectors	-

B. Prepare

(1) On Captain's and First Officer's side panels 12-211 and 5-212 make certain that LH and RH DASH INSTRUMENTS potentiometers are in the OFF position.

(2) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
VSI/TCAS, PILOT	13-215	S95	E4
VSI/TCAS, CO-PILOT	13-216	S96	F8
RH DASH INST LTS SUP.	13-216	L371	E9
LH DASH INST LTS SUP.	13-215	L372	A12

RB

C. Remove (Ref. Fig. 401)

(1) First Officer's VSI/TCAS indicator (S88)

(a) Loosen and remove the four mounting screws (4), which attach the adapter plate (3).

(b) Remove adapter plate (3).

(c) Carefully remove VSI/TCAS indicator (2) from its seating (8) and support indicator.

(d) Under instrument panel, disconnect the connector (7) from indicator.

(e) Withdraw VSI/TCAS indicator (2).

(f) Cap electrical connector (7).

(2) Captain's VSI/TCAS indicator.

(a) Remove the four screws securing the standby horizon (Ref. 34-22-00) and remove the standby horizon on the slack cable, but do not disconnect it.

(b) Carry out the procedure detailed in para. C. (1).

D. Preparation of Replacement Component

(1) Make certain that indicator seating is clean and that connectors and aircraft wiring are in correct condition.

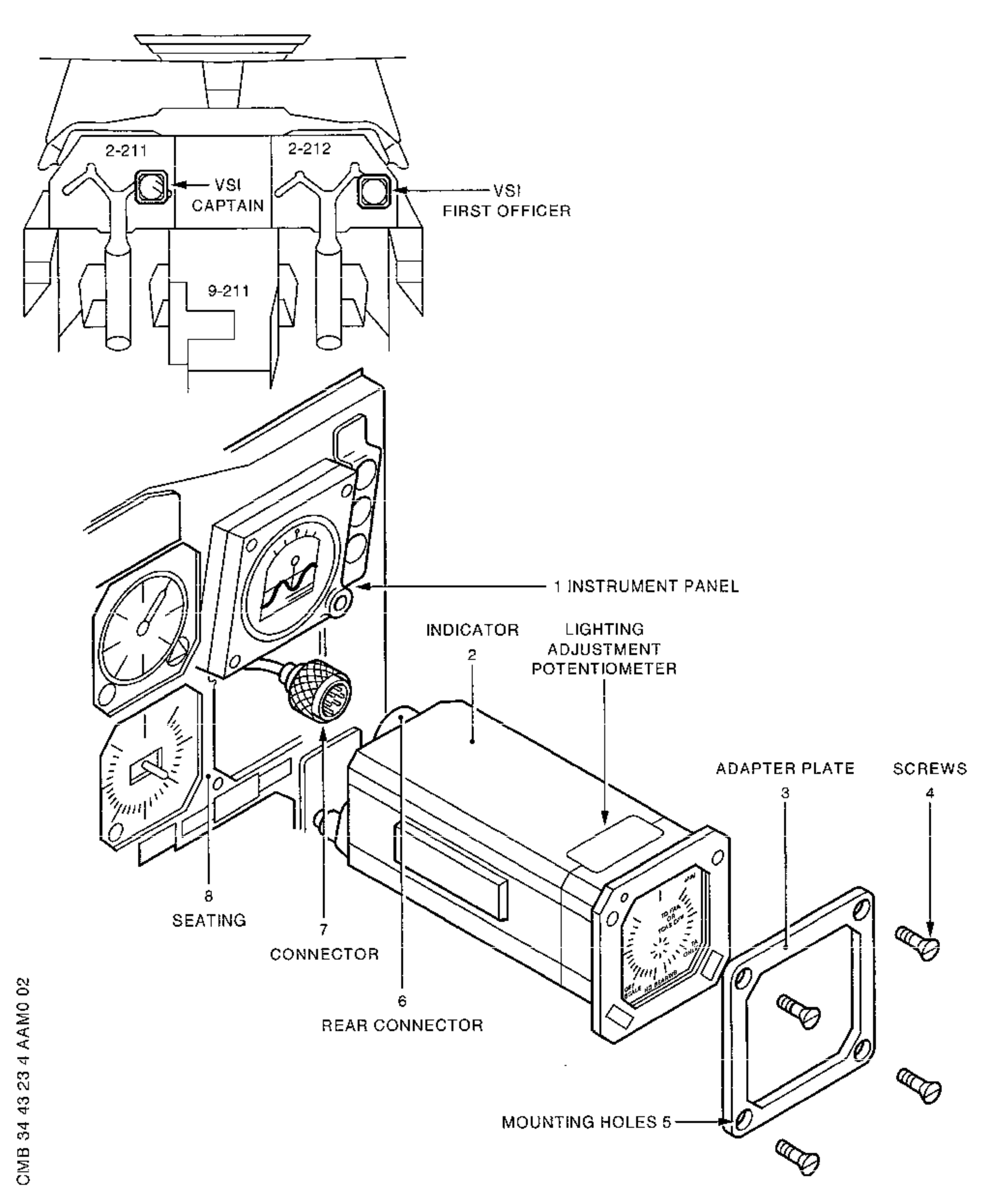
(2) Visually check indicator for correct external condition, that connectors are undamaged and have no traces of corrosion.

E. Install (Ref. Fig. 401)

(1) First Officer's VSI/TCAS indicator

RB NOTE: Ensure that only indicators with modification
RB amendment 'G' are used in the First Officers
RB position. (Check for modification Amendment
RB level 'G' stamped on the mod status plate on
RB the back of the indicator). If indicators
RB with amendment 'G' are not available, after
RB connecting the replacement IVSI, set the
RB circuit breaker, turn off all spotlights and
RB dash panel floodlights and turn the instrument
RB lighting control knob to mid position.

RB CAUTION: TAKE CARE IN THE FOLLOWING ADJUSTMENT AS THE
RB POTENTIOMETER IS VERY DELICATE AND THERE IS
RB NO HARD END-STOP. LISTEN FOR QUIET "CLICKS"
RB AS THE POTENTIOMETER IS ROTATED TO DETERMINE
RB IF THE END OF THE ADJUSTMENT RANGE IS
RB REACHED.



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Removal/Installation of VSI/TCAS Indicator
Figure 401

NOTE: Turn the recessed lighting adjustment potentiometer on the top of the body of the indicator in an anti-clockwise direction with a flat bladed jewellers screwdriver to minimise the illumination of the indicator.

(a) Remove blanking caps from connectors (6) and (7).

(b) Position VSI/TCAS indicator (2) facing its seating (8) and carefully install.

(c) Under instrument panel, connect aircraft connector (7) to indicator rear connector (6).

(d) Push VSI/TCAS indicator (2) fully against instrument panel (1).

(e) Position adapter plate (3) and install and tighten the screws (4) in adapter plate holes (5).

(2) Captain's VSI/TCAS indicator

RB NOTE: After connecting the replacement Captain's
RB IVSI, set the circuit breaker.

RB CAUTION: TAKE CARE IN THE FOLLOWING ADJUSTMENT AS THE
RB POTENTIOMETER IS VERY DELICATE AND THERE IS
RB NO HARD END-STOP. LISTEN FOR QUIET "CLICKS"
RB AS THE POTENTIOMETER IS ROTATED TO DETERMINE
RB IF THE END OF THE ADJUSTMENT RANGE IS
RB REACHED.

RB NOTE: Turn the recessed lighting adjustment
RB potentiometer on the top of the body of the
RB indicator in a clockwise direction with a flat
RB bladed jewellers screwdriver to maximise the
RB illumination of the indicator.

(a) Carry out procedure detailed in para. 2.E.(1).

(b) Install standby horizon indicator (Ref. 34-22-00) Removal/Installation.

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in para. 2.B.(2).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00 Adjustment/Test).

(4) Adjust LH DASH INSTRUMENTS, panel 12-211 or RH DASH INSTRUMENTS, panel 5-212 potentiometers to obtain correct illumination of indicator face.

RB NOTE: The IVSI vertical speed pointer should be at zero feet per minute (± 50ft/min). There is no zeroing adjustment for the IVSI pointer as there is with the strip VSI pointer (on the VSI amplifier).

RB If there is an offset on the pointer of the VSI part of the TCAS indicator, fault finding should be performed in the following way:

RB There are two main reasons for an excessive offset on the IVSI. This could be within the IVSI or in the ADC amplifier that provides the vertical speed signal to the IVSI's.

RB If both the IVSI's have an excessive offset, the likely cause is the ADC amplifier. A replacement amplifier should correct the offset.

RB If only one IVSI has an excessive offset, then either the IVSI or the ADC amplifier could be the problem.

RB To check which unit has the fault, interchange the IVSI's and see if the offset remains on the original side or moves across to the other side with the original indicator showing the offset. If the offset moves with the indicator, then the IVSI requires replacement. If the offset remains on the original side, then the ADC amplifier requires replacement.

(5) Test TCAS (Ref. 34-43-00, Adjustment/Test and TCAS-21 Operator's Guide IFR).

G. Close-Up

(1) On side panels 12-211 and 5-212 place LH and RH DASH INSTRUMENTS potentiometers in OFF position.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

TCAS COMPUTER - REMOVAL/INSTALLATION

1. General

   A. The TCAS computer S85 is installed on shelf 5-215 RH side.

2. Removal/Installation

   A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	-
Blanking Caps	-
Ventilation Outlet Blanking Plates	-

   B. Prepare

      (1) Remove front panel DS from shelf 5-215.

      (2) Trip, safety and tag the following circuit breakers:

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	AUDIO WARNING SYS SUP 1	1-213	W371	M21
	MWS SUP 1		W252	N21
	RAD ALT 1 SUP	2-213	1S56	D 8
RB	INS 1 HTR & SYS SUP		1F14	E 6
RB	INS 1 HTR SUP		1F20	F 6
	COMPASS COUPLER 1 SUP		1F130	F 8
	ATC 1 MODE S		S13	G20
	AUDIO WARNING SYS SUP 2	5-213	W372	C17
	MWS SUP 2		W251	D15
	TCAS	13-215	S86	D 4
	VSI/TCAS PILOT		S95	E 4
	GRND PROXIMITY WARN AC SUP		W631	G 4
	ATC 2 MODE S	13-216	S14	F 7
	VSI/TCAS CO-PILOT		S96	F 8
	RAD ALT 2 SUP		2S56	F19

(3) On centre console panel 9-211, on ADC control panel, make certain that ADC 1 and ADC 2 ON/OFF switches are in OFF position.

(4) On centre console panel (9-211) on ATC Mode S control unit (S11), make certain that:

(a) Selector STBY - XPDR - TA - RA/TA switch in STBY position, and ALT RPTG is in the OFF position.

C. Remove TCAS computer

(1) Gain access to shelf 5-215.

(2) Refer to 34-00-00, Removal/Installation, para. 2.D.(1).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, para. 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, para. 2.F.(1).

F. Test

RB (1) Carry out TCAS test in self-test mode (Ref. 34-43-00, Adjustment/Test, Operational Test).

G. Close-Up

(1) Install front panel DS on shelf 5-215.

TCAS AUDIO MIXING BOX - REMOVAL/INSTALLATION

1. General

The TCAS Audio Mixing Box S89 is located on electrical junction box 05-215, shelf 5-215, LH side.

2. Removal/Installation

A. Materials and Equipment

DESCRIPTION	PART No.
Circuit Breaker Safety Clips	-
Blanking Caps	-

B. Prepare

(1) Remove front panel DS from shelf 5-215.

(2) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
AUDIO WARN SYSTEM SUP 1	1-213	W371	M21
AUDIO WARN SYSTEM SUP 2	5-213	W372	C17
TCAS	13-215	S86	D4
GRD PROXIMITY WARN AC SUP	13-215	W631	G4
GRD PROXIMITY WARN DC SUP	15-215	W632	G7

C. Remove Audio Mixing Box

(1) Gain access to electrical junction box 05-215, shelf 5-215, and locate audio mixing box S89.

(2) Disconnect electrical connector S89A from mixing box. Cap electrical connectors.

(3) Loosen and remove the two bolts and washers securing the mixing box and mounting plate assembly to junction box 05-215. Withdraw mixing box and mounting plate assembly from locating spigots.

(4) Loosen and remove the four screws and washers securing the mixing box to the mounting plate.

D. Preparation of replacement component

(1) Ensure mixing box and mounting plate mating areas are clean and free from corrosion and that connectors and aircraft wiring are in good condition.

E. Install

(1) Fit mixing box to mounting plate with four screws and washers.

(2) Locate mixing box and mounting plate assembly to spigots on junction box 05-215 and secure with two bolts and washers.

(3) Remove blanking caps from electrical connectors and connect aircraft free connector S89A to mixing box.

F. Test

(1) Remove safety clips and tags, then reset circuit breakers previously tripped in paragraph 2.B.(2).

(2) Carry out TCAS functional test (Ref. 34-43-00, Adjustment/Test).

(3) Carry out GPWS self test (Ref. 34-47-00, Adjustment/Test).

G. Close-up

(1) Install front panel DS on shelf 5-215.

VSI/TCAS ADC AMPLIFIER - REMOVAL/INSTALLATION

1. General

The VSI/TCAS ADC amplifier S94 is located on the racking support structure 17-215 above shelf 7-215, LH side.

2. Removal/Installation

A. Materials and Equipment

DESCRIPTION	PART No.
Circuit Breaker Safety Clips	-
Blanking Caps	-
Cable Ties	NSA935401-03

B. Prepare

(1) Remove front panel DS from shelf 7-215.

(2) Trip, safety and tag the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
1ST PLT VSI SUP	2-213	1F97	A3
2ND PLT VSI SUP	13-216	2F97	B13

(3) On centre console panel 9-211, ADC control panel, ensure that ADC1 and ADC2 ON/OFF switches are in OFF position.

C. Remove VSI/TCAS ADC Amplifier

(1) Gain access to shelf 7-215 and locate amplifier S94.

(2) Disconnect electrical connector S94A from amplifier. Cap electrical connectors.

(3) Carefully cut and remove the two cable ties securing wiring to earth point UN17-215-1 taking care not to loose spacers.

(4) Loosen and remove the two bolts securing the amplifier and mounting plate assembly to support structure.

(5) If earth point wiring length allows, withdraw the amplifier and mounting plate assembly from locating spigots. If wiring length prohibits removal, disconnect earth point UN17-215-1.

(6) Loosen and remove the four screws and nuts securing the amplifier to the mounting plate.

D. Preparation of replacement component

(1) Ensure amplifier and mounting plate mating areas are clean and free from corrosion and that connectors and aircraft wiring are in good condition.

E. Install

(1) Fit amplifier to mounting plate with four screws and nuts.

(2) Locate amplifier and mounting plate assembly to spigots and secure with two bolts to support structure.

(3) If earth point UN17-215-1 was disconnected in step 2.C.(5) above, reconnect earth point. (Ref. WDM 20-41-05)

(4) Secure earth point wiring to mounting plate using two cable ties and spacers retained from step 2.C.(3).

(5) Remove blanking caps from electrical connectors and connect aircraft free connector S94A to amplifier.

F. Test

(1) Remove safety clips and tags, then reset circuit breakers previously tripped in paragraph 2.B.(2).

(2) Carry out TCAS functional test (Ref. 34-43-00, Adjustment/Test).

G. Close-up

(1) Install front panel DS on shelf 7-215.

INERTIAL NAVIGATION SYSTEM - DESCRIPTION AND OPERATION

R B NOTE: After MOD 34C297 No. 1 and No. 2 ADEU is removed and
R B all references should be ignored.

1. General

The purpose of navigation is to enable a moving vehicle to follow a selected track and to be able to know its position at any given time. Inertia is the ability of bodies to maintain their state of motion or to resist any variations of motion imposed on them : Inertial navigation systems making use of Newton's laws of physics enable navigation without external aids to be carried out with increased reliability and without possibility of external interference.
The inertial navigation technique makes use of two parameters :

- Speed, variation of position with time
- Acceleration, variation of speed as a function of time.

The magnitude of inertial force developed by a body is proportional to the external force applied to it. The resulting acceleration of the body is proportional to the magnitude of inertial force, that is, force = mass x acceleration.
Knowing the mass, acceleration is obtained by measuring inertial force and this enables the position of the moving vehicle to be known at any given time : Acceleration can be measured by an accelerometer.

A. Accelerometer (Ref. Fig. 001)

A linear accelerometer consists of two mechanical parts, a case and a weight which can slide freely along an axis known as the sense axis and is maintained in a median position by two springs when no external force is applied to the device. When an external force is applied its speed is changed, the inertia of mass M opposes the change of motion and the spring tension changes until the applied force equals the inertial force of the mass.
Equilibrium is again restored and the mass then moves at the same speed as the case. Measurement of displacement of the mass with respect to the case gives the measurement of acceleration of the latter or of the vehicle to which the accelerometer is fitted. It should be noted however that the accelerometer only measures accelerations along its sense axis.

B. Accelerometer Servo-Control (Ref. Fig. 002)

(1) Displacement of the mass with respect to the casing is detected by means of electro-magnetic detectors. They consist of two primary windings attached to the case and a secondary winding on the mass. The two

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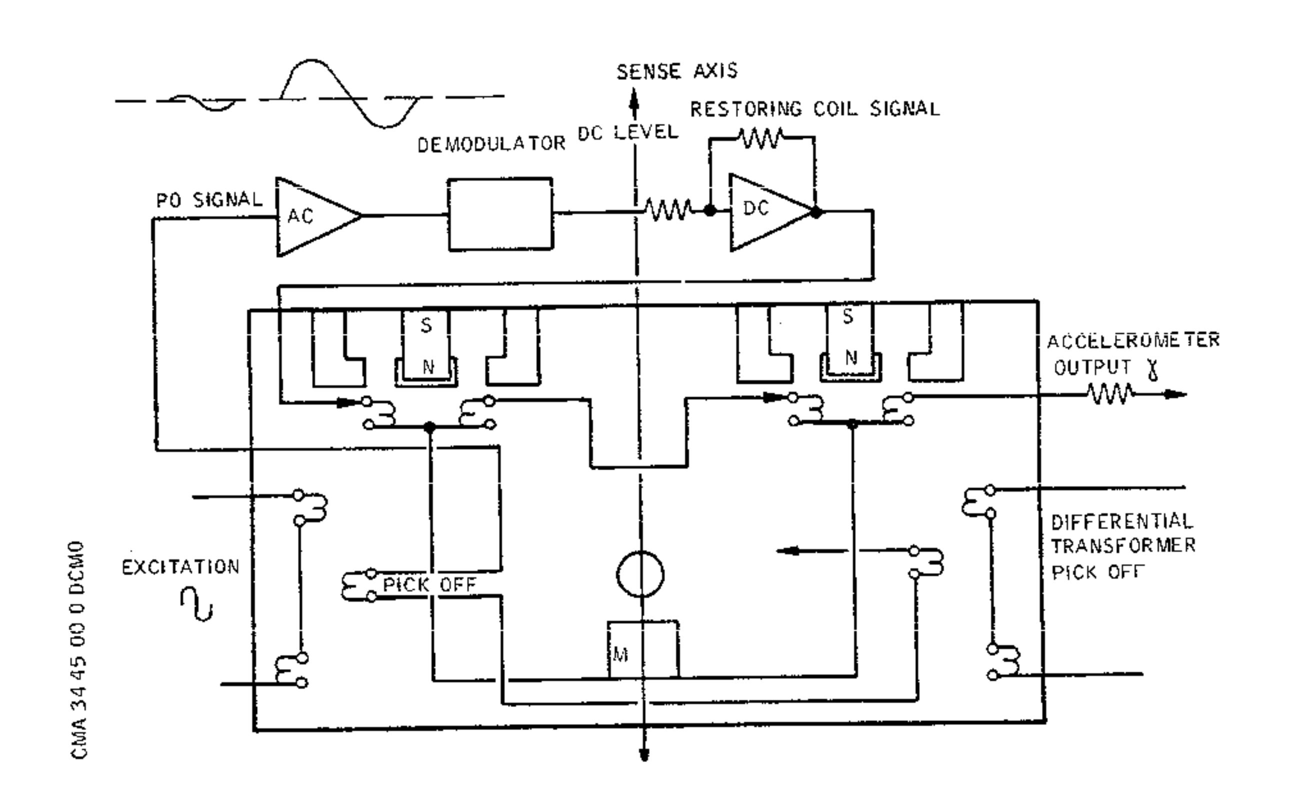
EXTERNAL FORCE
SENSE AXIS
M
SPRING
SPRING

CMA 34 45 00 0 DAM0

Principle of the Linear Accelerometer.
Figure 001

primary windings, located at equal distance from the zero, are energized by a current of the same frequency and amplitude, but of opposite phase. At zero, the resulting field induced in the secondary winding is zero.
Under the influence of an acceleration, the secondary winding - or pick-off - is subjected to the preponderant induction of one of the primary windings. The phase of the output signal indicates acceleration direction, and its amplitude is proportional to the magnitude of the acceleration.
The amplified output signal is demodulated. To return the accelerometer to its zero position, the demodulator output current energizes the torque coils in the case so that the field interaction with that of the permanent magnets attached to the pendulum brings the latter back to its position of origin. Thus, in place of measuring a displacement, the current required to oppose a displacement is measured.
The result is a signal proportional to acceleration.

C. Horizontal Plane Navigation (Ref. Fig. 003)

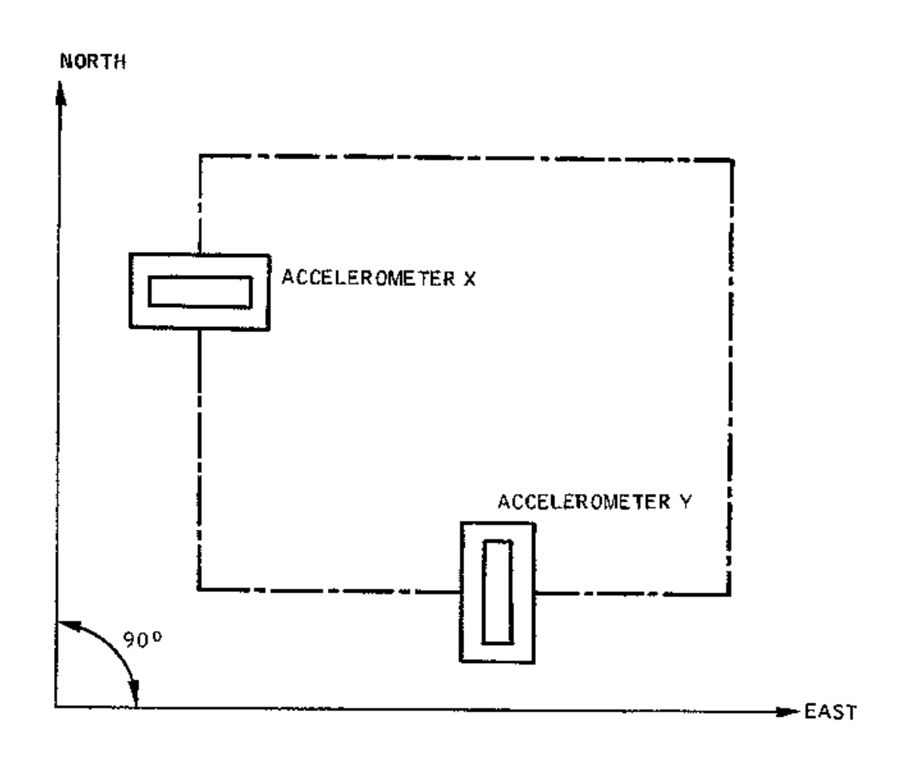


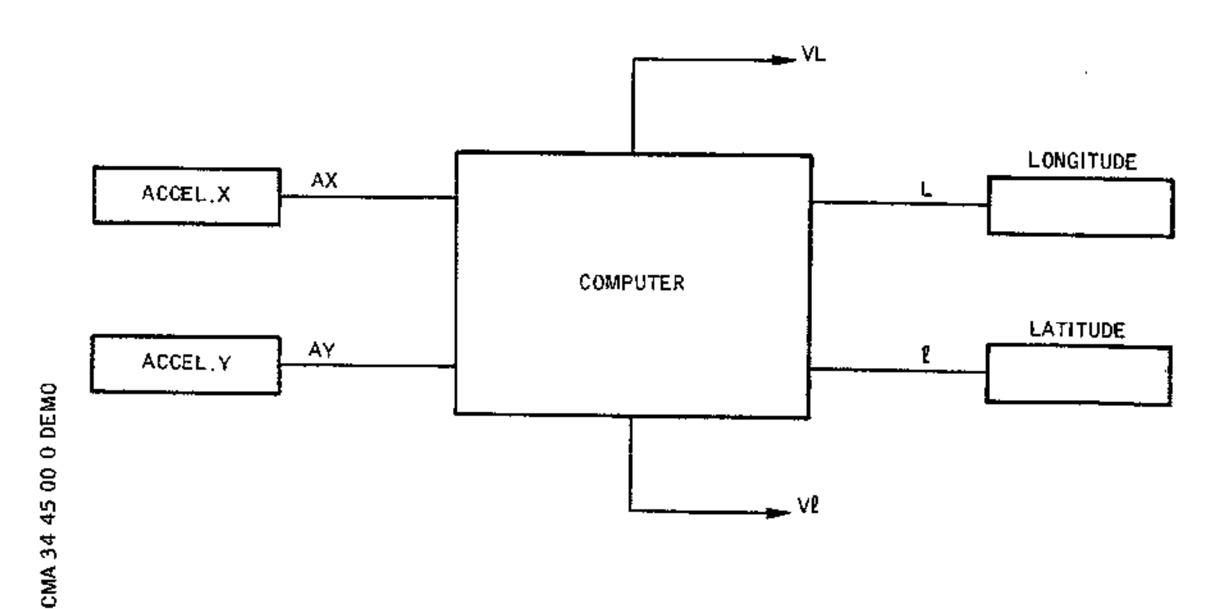
Principle of Detection - Servo-Control Loop
Figure 002

To measure acceleration, speed and displacement in a horizontal plane, acceleration on two non-parallel axes must be measured. This is achieved by assembling two accelerometers on the same base, with their axes perpendicular to each other. If this system of coordinates is maintained with a fixed and known orientation with respect to earth coordinates, - latitude and longitude - the measured accelerations can be expressed as earth coordinates. After double integration a computer expresses the position of the carrying vehicle in latitude and longitude coordinates. To establish speed and distance it is not sufficient to have two accelerometers on one base, the position of the base, and therefore the platform also has to be known in relation to the earth and to the movements of the carrying vehicle. This position check is obtained by stabilization of the platform by means of gyroscopes used as rotation detectors and which are slaved to true North.

D. Gyroscope (Ref. Fig. 004)

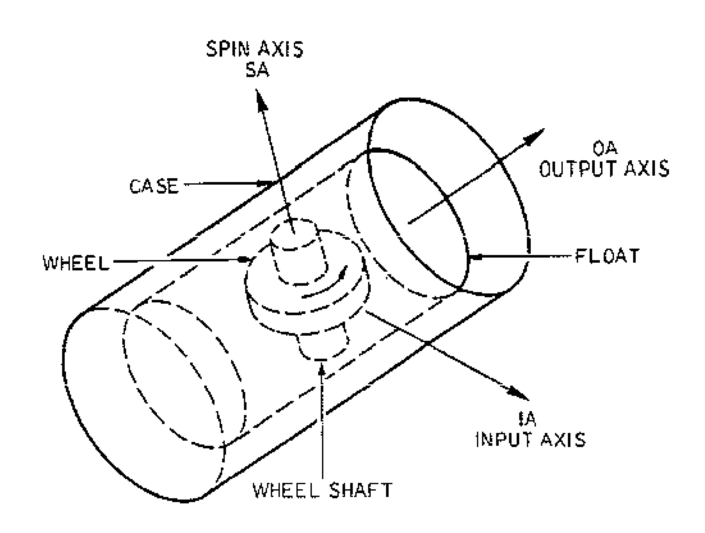
A gyroscope can be defined as a mass-generally a flywheel or

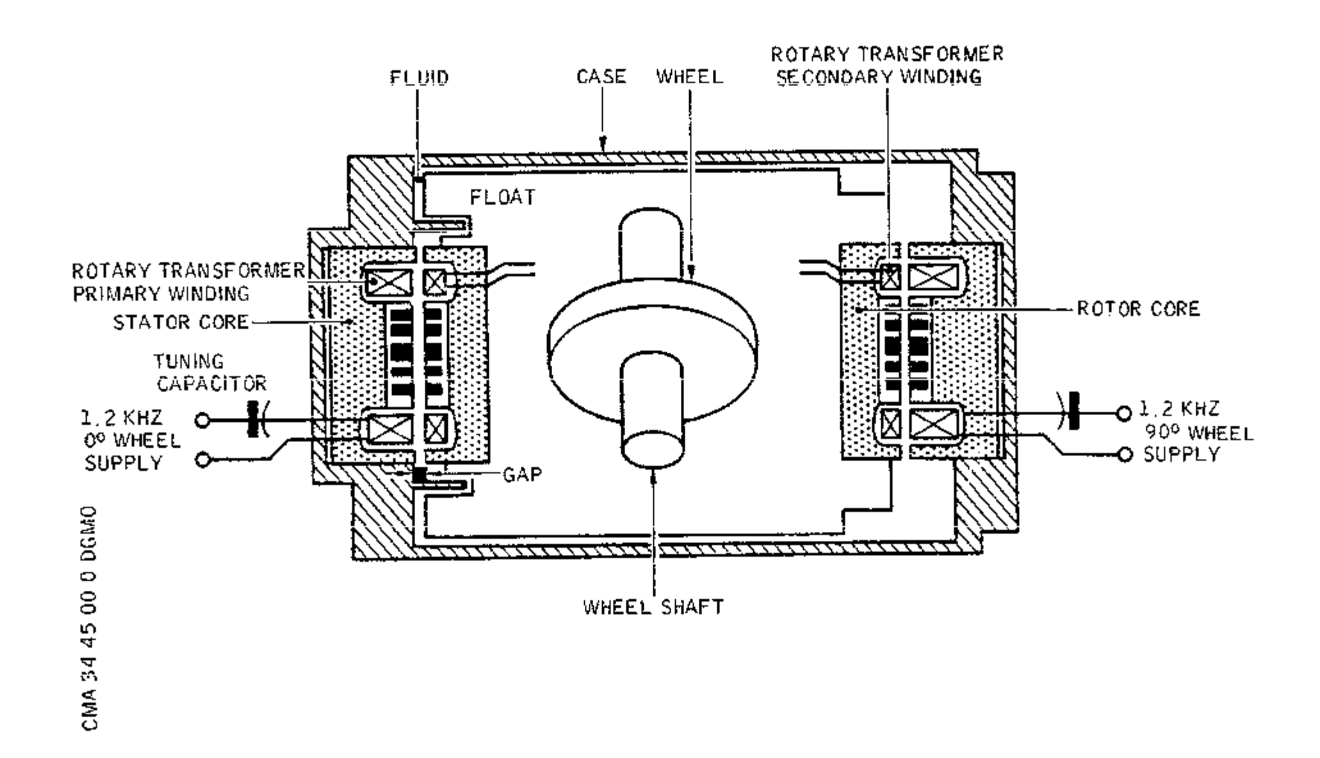




CMA 34 45 00 0 DEMO

Accelerator Installation - Acceleration Processing
Figure 003



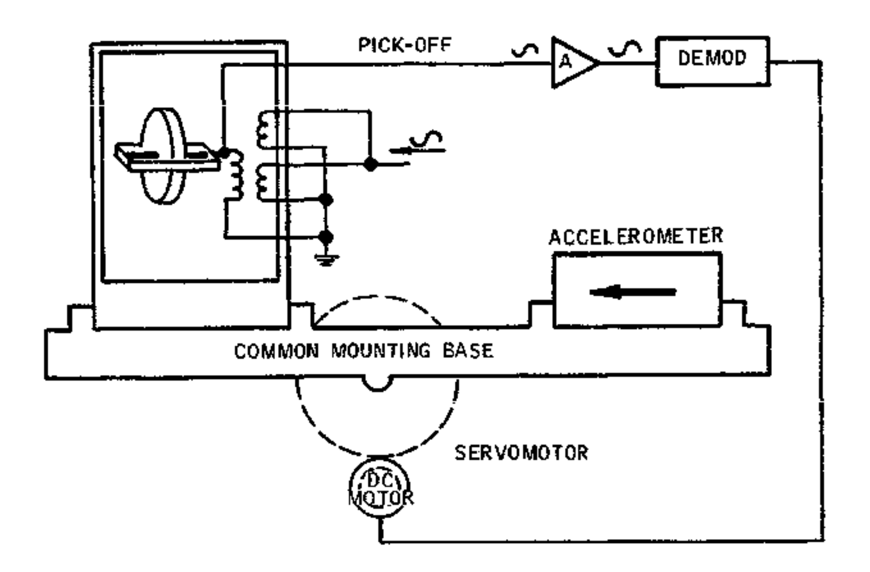


One Degree of Freedom Gyroscope
Figure 004

disc, driven at high speed around its spin axis, in this case, at a rate of 24,000 RPM by a two-phase synchronous, torque motor. The flywheel is housed in a cylinder known as the float assembly, in a fluid, (helium) which is contained in the gyroscope case. The float assembly is able to move freely according to its output axis (longitudinal axis OA), perpendicular to the rotation axis of the flywheel. The float assembly has at each extremity, elements of an LC tuned circuit, the rotor consisting of a ferrite core, and the secondary of a rotary transformer which couples the power to the flywheel. The other part of the tuned circuit, the stator of the core and the primary of the rotary transformer are mounted integrally with the end of the case as well as the torque magnets. The float assembly centred in the fluid is magnetically suspended in the axial plane. Radial suspension is by means of the LC circuit, movement of the float assembly varies the inductance of the circuit. The magnets associated with the coils mounted on the stator constitute the capactive pick-off which detects input errors. The associated loop supplies the torque signals required for resetting of the gyro and thus of the platform according to the axes monitored by the gyroscopes. The elements associated with the pick-off circuit, resistors and a preamplifier form an integral part of the gyroscope, which is known as a one degree of freedom gyroscope as the float assembly rotates about one axis only. A gyroscope only reacts to the component of motion around its input axis (imaginary axis perpendicular to the spin axis). This component reacts on the output axis, this is known as precession, which, transformed into electrical energy (pick-off transformer) supplies the stabilization loop inputs.

E. Platform Stabilization (Ref. Fig.005 and 006)

The purpose of a stabilized platform is to provide the accelerometers with a support, the orientation of which is defined in space, that is to maintain the central mechanism in a fixed attitude. Three gyroscopes each with one degree of freedom enable stabilization of the platform.
Three servo channels x, y and z are associated with these gyroscopes.
The servo motors re-establish the attitude of the platform if the latter has angular freedom around the three axes. This is obtained by mounting it in a 4 gimbal system associated with the necessary synchros, resolvers, motors and torque motors. The synchros and resolvers in the first, third and fourth gimbals repeat the azimuth, pitch and roll signals required for inertial navigation and for external aircraft equipment. The fourth gimbal is subjected to angular detection between the first and second gimbal.



CMA 34 45 00 0 DJMO

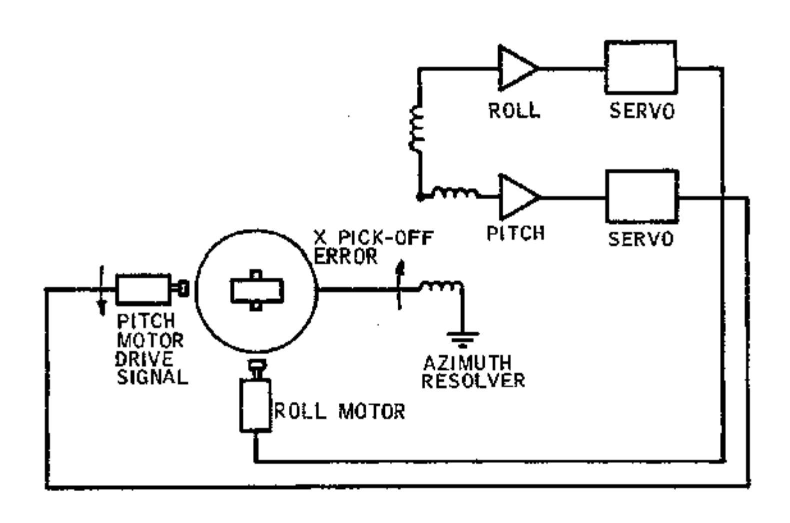
Platform Axis Stabilization Loop
Figure 005

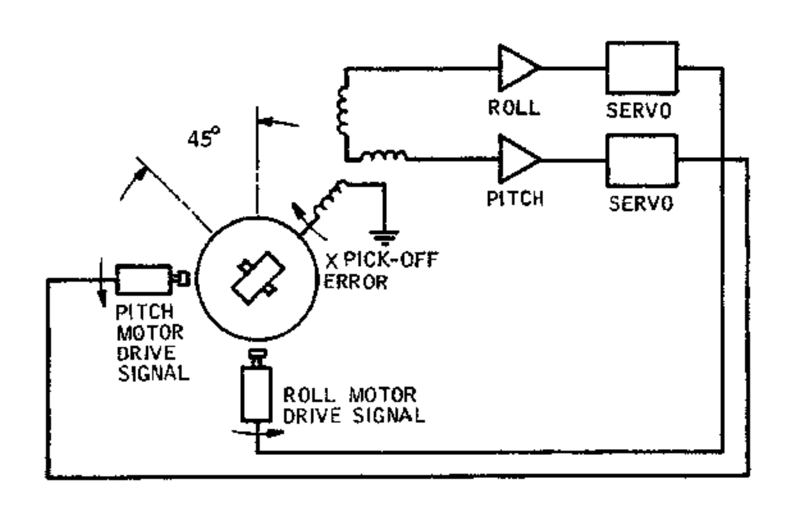
(1) Platform stabilization on an axis

The axis of rotation of a gyroscope maintains a fixed direction in space indefinitely.
To stabilize a platform axis, it is necessary to measure and then cancel the angular variations between the axis of rotation and the platform axis.
This is achieved by means of a detector, the primary winding of which is embodied in the gyro case, which is itself integral with the platform. The secondary is integral with the rotor. The servo channel, of which the output signal controls the servo motor, ensures the stabilization function.

(a) Azimuth resolver function

Each time the gyro detects an angular movement the servo-motor returns the central mechanism to its initial orientation.
Stabilization of the azimuth axis : in the first case the azimuth angle is zero degrees (pitch and roll axes are parallel) the error signal is sent





CMA 34 45 00 0 DLMO

Azimuth Resolver Function
Figure 006

through the resolver to the pitch servo-motor. In the second case, the azimuth angle is 45°. The azimuth resolver splits the signal and sends approximately 70 per cent to the pitch and roll motors simultaneously in such a way that the platform is brought back to the preceding case.

(2) Displacement of the platform on a meridian (Ref. Fig. 007)

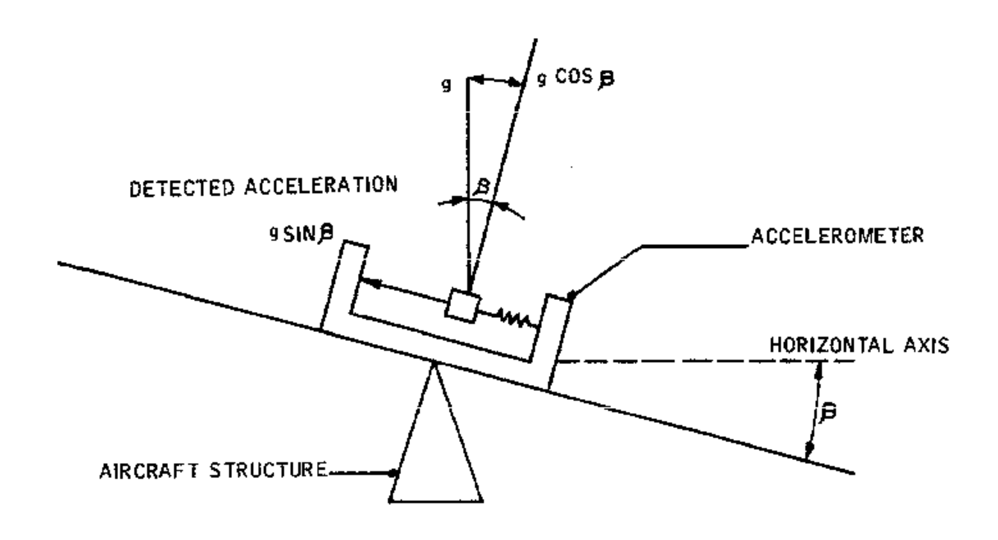
When the accelerometer plane is not horizontal the mass applies to the case a reaction force perpendicular to the accelerometer plane. This force balances earth attraction force. In addition an acceleration is detected even though the carrying vehicle is not in motion.
This acceleration, translated into speed and displacement by the computer, produces an error and hence the need to maintain the platform in a horizontal plane.

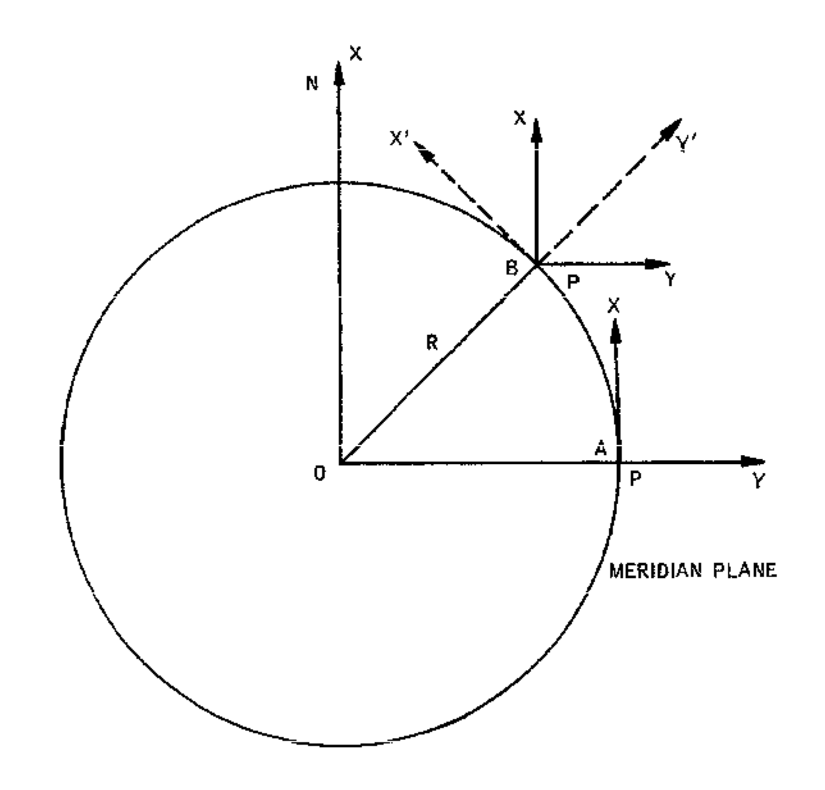
(a) Displacement on a meridian

At point A on the equator, the XY axes are in the horizontal plane. At point B the plane has been subjected to a pitch rotation about axis OY, resulting from the speed of the vehicle and earth influence.
To maintain the XY axes in a horizontal plane it must be rotated about the OY axis. The rate of rotation is calculated by the computer from accelerometer information. This precession rate is applied to gyroscope Y which turns the platform an equal amount about the OY axis.

(3) Displacement on a parallel (Ref. Fig. 008)

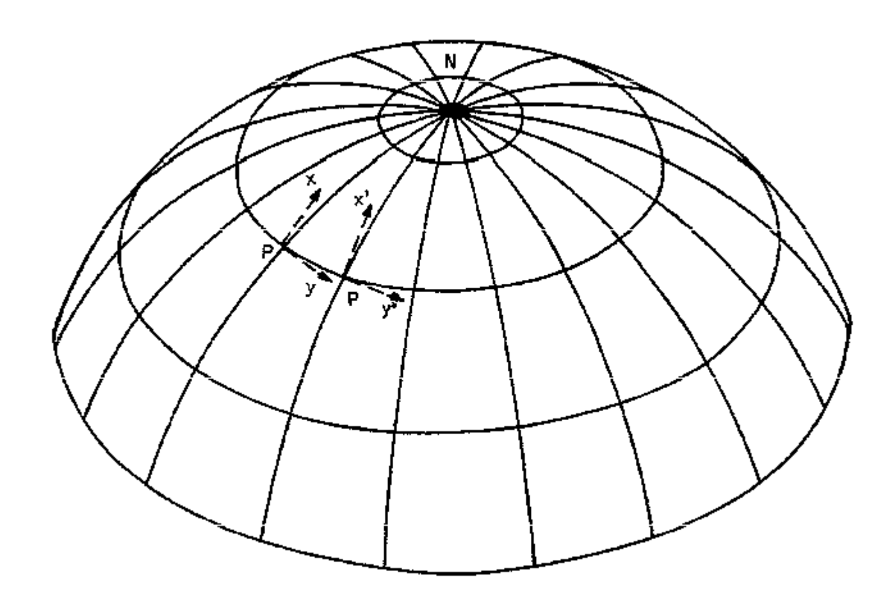
When the vehicle moves along a parallel, its rotation angle about the axis PN divides into two rotations about axes Px and Py respectively. The North oriented axis Px turns in a horizontal plane. This rotation due to the convergence of the meridians shows that the rate of rotation increases as the pole is approached, to reach infinity at the pole. This is the reason why inertial navigation systems which have their platforms slaved to North cannot be used at latitudes above 75/80° North or South this being the limit of accuracy which can be accepted by the gyros. In order to remedy this failing, free azimuth platforms are used, on which the X gyro forms an alpha angle with North which varies as a function of air-





CMA 34 45 00 0 DNM0

Influence of Earth Attraction -
Displacement on a Meridian
Figure 007



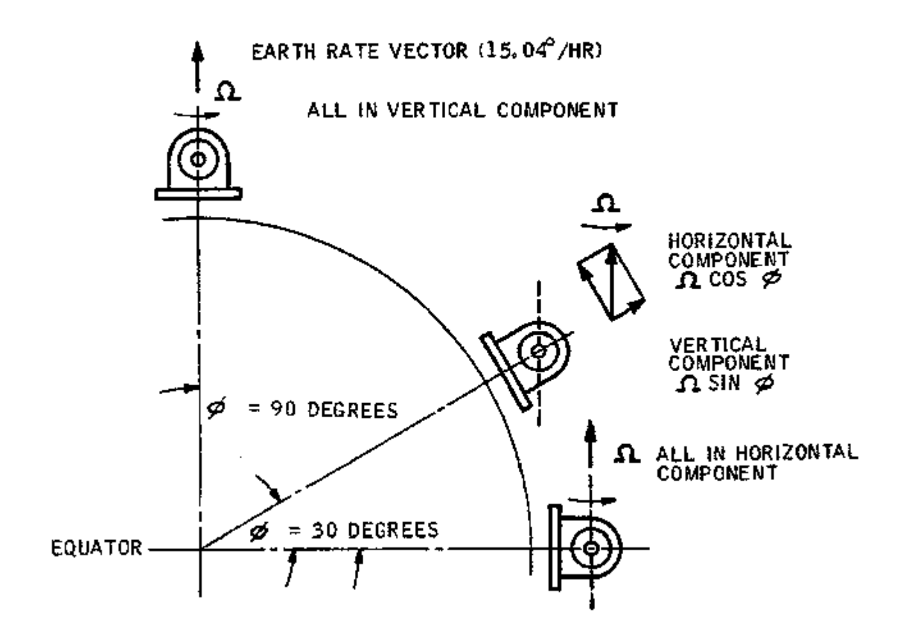
CMA 34 45 00 0 DQMO

Displacement on a Parallel
Figure 008

craft displacement and is calculated continuously by the computer, which knows aircraft latitude position and applies earth rotation rate correction. The computer translates these values into a precession rate transmitted to X and Y gyros, which maintain the platform axes in a North direction.

(4) Earth Rotation Influence (Ref. Fig. 009)

At the equator, the earth rotation axis is in the horizontal plane, the horizontal component is maximum, the vertical component nil.
At the pole, earth rotation axis is perpendicular to the horizontal plane, horizontal component is nil, vertical component is maximum. Note that maximum earth rotation rate is 15.04°/Hr. For example, at a latitude of 30° the horizontal component, will be of the order of omega cos phi, that is 13.02°/Hr. The vertical component will be omega sin phi, that is 7.52°/Hr. This is the rate of rotation constantly detected which, after processing in the computer determines the rate of precession to be applied to the



Horizontal and Vertical Components of
Earth Rotation Rate
Figure 009

gyros in order to maintain platform slaving to North.

(5) Additional corrections

The accelerations relative to earth rotation and coriolis must be subtracted from the absolute acceleration components detected by the accelerometers. These components are calculated by the computer associated with the INS.

(6) Inertial navigation system stabilization loop

The navigation calculations must be made in the horizontal plane. It is thus necessary to have a central mechanism platform as nearly horizontal as possible in fine alignment (just before initialization of navigation calculations).
For this purpose the schuler pendulum equation is introduced in the integrated platform oscillation amplitudes expression in the stabilization loop (pendulum length is equal to earth radius). Thus the

platform oscillations are made independent of platform accelerations, thus avoiding system deviation.

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R 2. Inertial Navigation System (Ref. Fig.010 and 011)

A. The inertial navigation system (INS) automatically determines the navigation and attitude data of the aircraft to keep the aircraft on a predetermined course. External information inputs to the INS include barometric altitude and true airspeed from the air data computer (ADC) and distance data from the DME system. The INS does not require these data inputs but without them it will operate with degraded performance. The navigation data is displayed on flight instruments, allowing the flight crew to fly the aircraft to the INS reference. The data is also supplied to the autopilot systems allowing the aircraft to be automatically flown along the computed course.

B. Three separate Delco Carousel CIV-A INS systems are installed in the aircraft. Each INS consists of a mode selector unit (MSU), a control/display unit (CDU), a navigation unit (NU), an automatic data entry unit (ADEU) and a battery unit (BU).

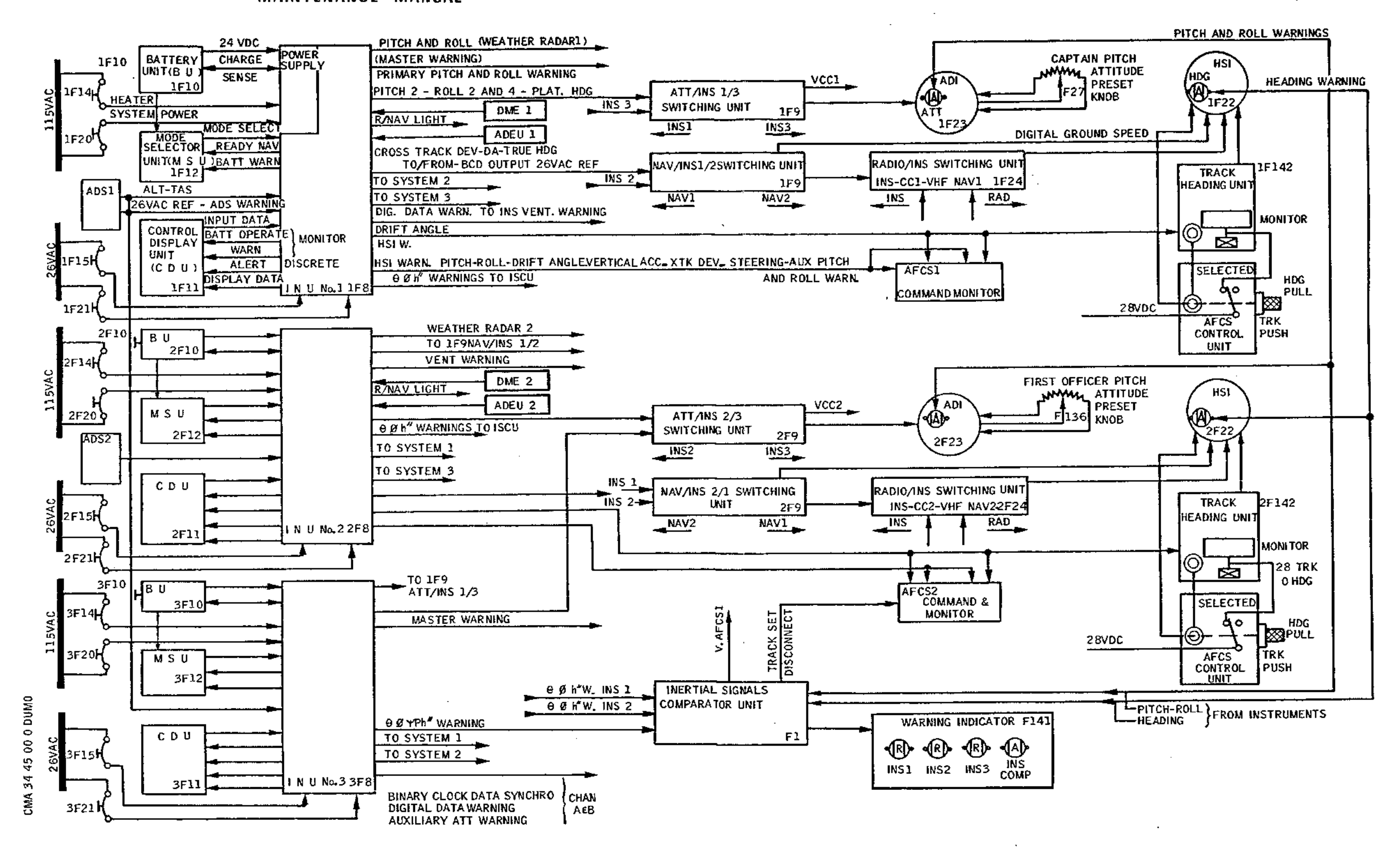
C. The INS continuously computes horizontal navigation data and senses aircraft attitude displacements in pitch, roll, and yaw from a local horizontal reference. Output signals from the INS are used to steer the aircraft over a computed course to a preselected destination, to maintain the aircraft and the weather radar display at a level attitude, and to display navigation data and aircraft attitude on navigation and flight instruments. Each INS furnishes a numerical display of its navigation data and operating status.

D. The INS navigation unit contains a gyro stabilized gimbal assembly which senses all changes in aircraft attitude and acceleration. Attitude stabilization signals are produced for aircraft movement about its pitch, roll, and yaw axes. Instruments in the gimbal assembly sense all vertical and horizontal accelerations (velocity changes). The velocity change signals, air data computer signals, and manually inserted position data are used by a digital computer in the navigation unit. The digital computer uses the input signals to continuously solve navigation equations, to produce output signals for automatic steering along the desired track, and for display of the computed data.

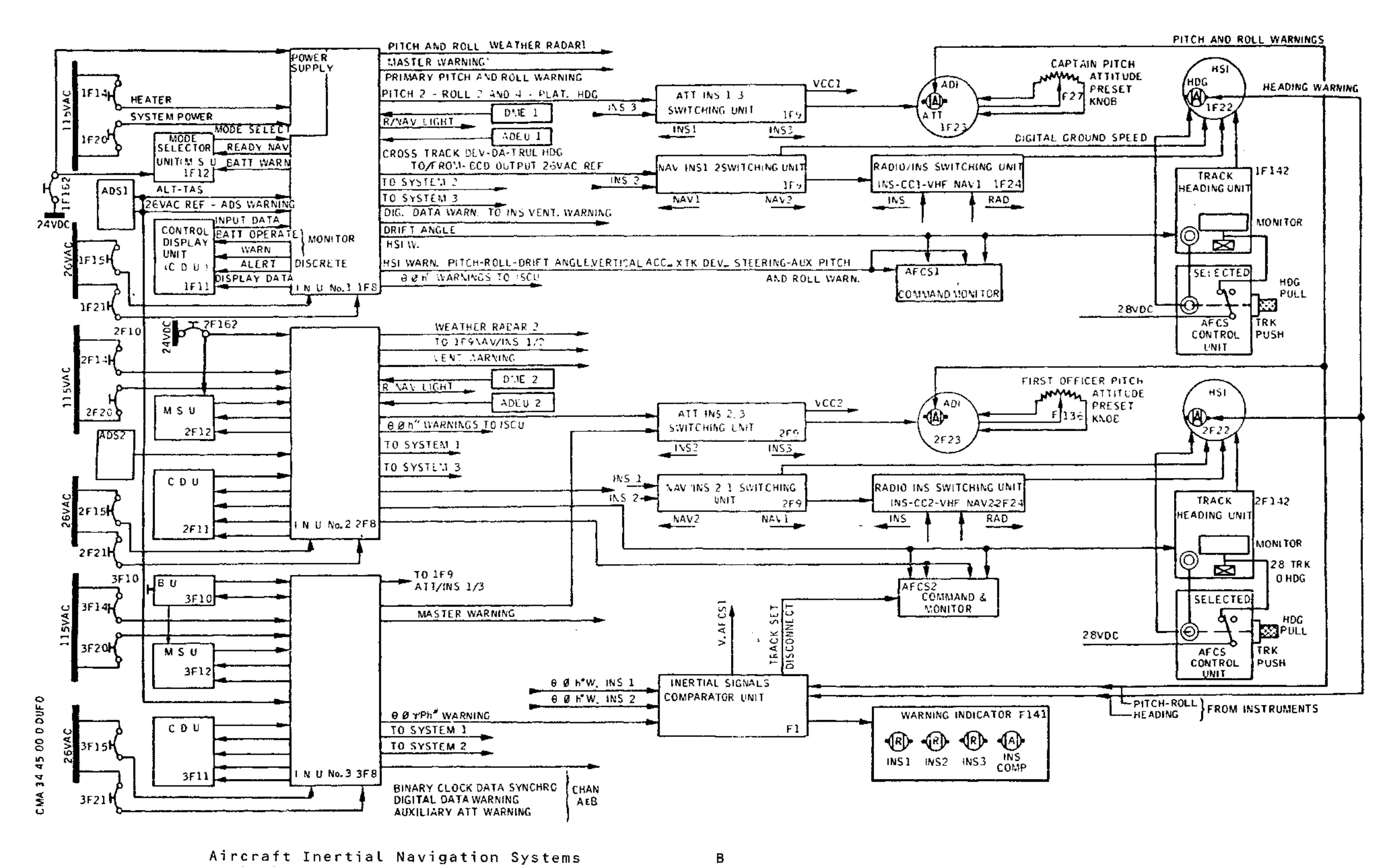
E. The INS is characterized by the following features:

(1) Automatic self-alignment and calibration are accomplished each time the INS is turned on.

(2) Automatic calibration of the azimuth gyro which is accomplished as follows.



Aircraft Inertial Navigation Systems - Block Diagram
Figure 010



Aircraft Inertial Navigation Systems B
Block Diagram after Mod CM 42611 B
Figure 011

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EFFECTIVITY: ALL

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(a) An automatic calibration based on the results of the preceding flight is accomplished during the subsequent alignment.

(b) A further refinement of the calibration based on alignment data is accomplished automatically at entry into NAV if an alignment to mode 4 or lower is obtained.

(3) Uses (but does not require) inputs from external navigation aids.

(4) Monitors its own performance and furnishes warning indications when output signals and displayed data are unreliable.

(5) Waypoint and DME station (Ref. Fig. 012)

Waypoint co-ordinates and DME station co-ordinates, altitude and frequency can be inserted manually through a keyboard or automatically through an Automatic Data Entry Unit (ADEU). This information can be inserted into all INS simultaneously or into each INS separately.

(6) Operates accurately within any latitude and longitude encountered in flight, including polar flight.

(7) Indicating lights and displays can be replaced while INS is operating without hazard to equipment or personnel.

(8) Can be used to produce only attitude (roll, pitch and yaw) stabilization signals if navigation and/or steering signals become unreliable.

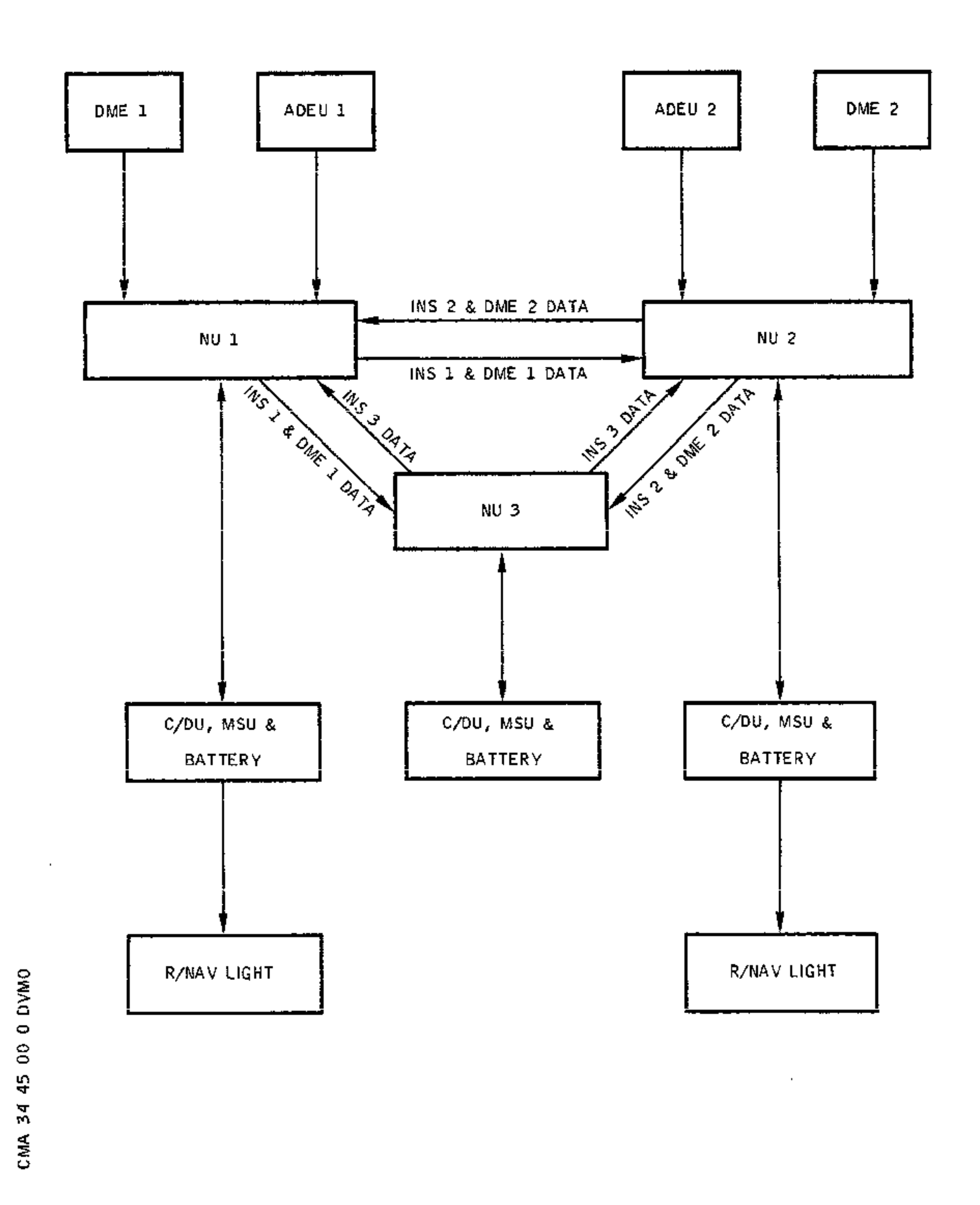
(9) If neither radio navigation signals nor a present position reference is available, the INS can improve its accuracy by mixing three inertial positions and generating an optimum inertial position.

(10) The INS can be automatically updated by radio navigation (DME) signals when such signals are available.

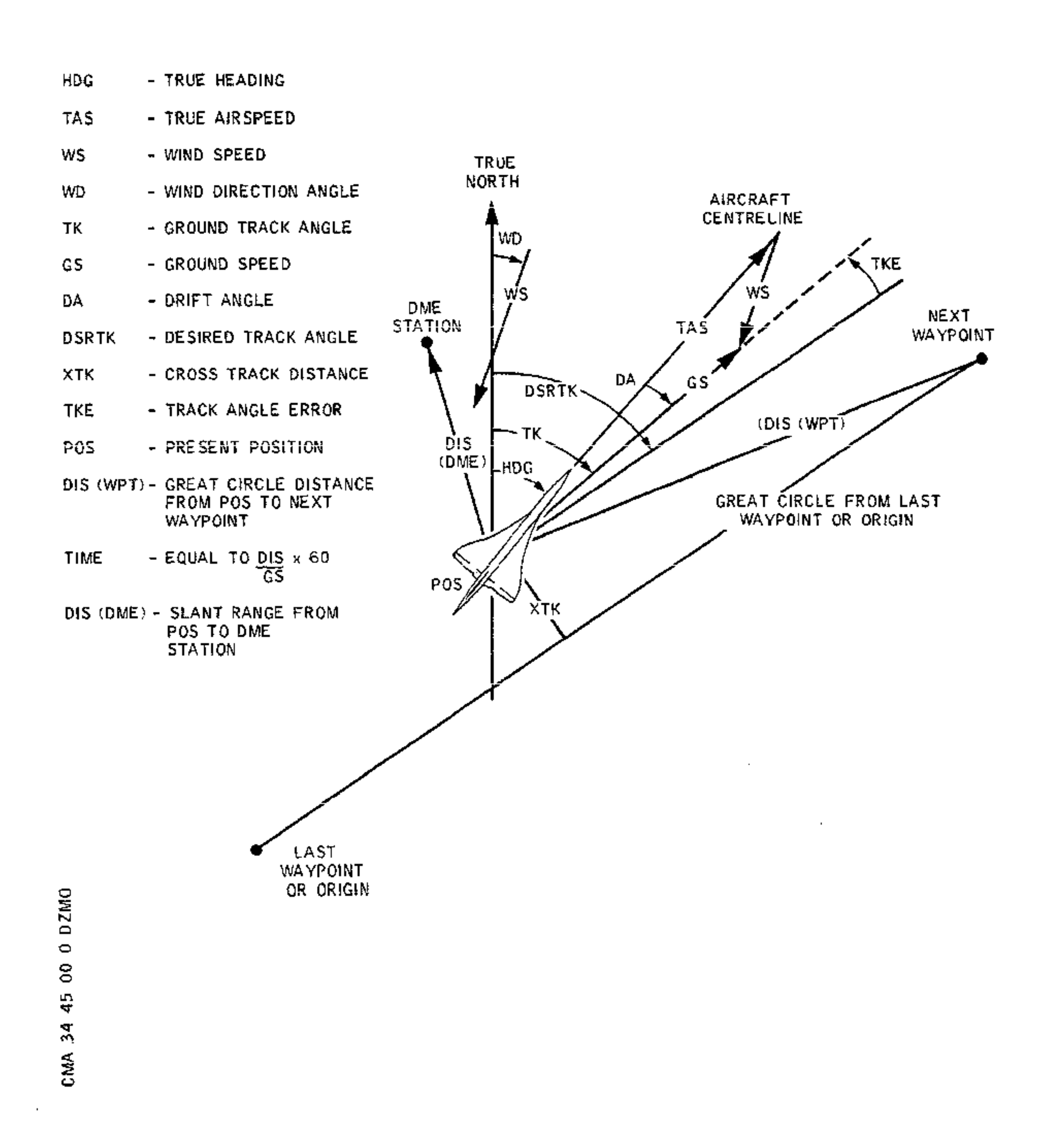
(11) Although barometric altitude and true airspeed from the air data system are inputs into the INS, loss of these inputs will not seriously affect INS operation.

F. Navigation Information Relationships (Ref. Fig. 013)

These relationships are displayed in digital form on the



DME Update and Triple Mixing System Interconnect
Figure 012



Navigation Information Relationships
Figure 013

control/display units and in analog form on the pilots' flight instruments.

(1) True heading (HDG) is the angle between the aircraft centreline and true North.

(2) True airspeed (TAS) is the airspeed of the aircraft with respect to the surrounding air.

(3) Wind speed (WS) is the magnitude of the wind velocity vector in knots.

(4) Wind direction angle (WD) is the angle between true North and the wind velocity vector.

(5) Ground track angle (TK) is the angle between true North and an imaginary line on the earth's surface connecting successive position points over which the aircraft has flown (ground track).

(6) Ground speed (GS) is the velocity with which the aircraft is moving over the earth's surface.

(7) Drift angle (DA) is the angle between the aircraft's true heading and ground track.

(8) Desired track angle (DSRTK) is the angle between true North and an imaginary line on the ground connecting successive position points desired to overfly; this line being the great circle segment that lies between two successive waypoints.

(9) Present position (POS) is the actual latitude and longitude position of the aircraft.

(10) Cross track distance (XTK) is the shortest distance between the aircraft's present position and the desired track.

(11) Track angle error (TKE) is the angle between the aircraft's actual ground track and the desired ground track.

(12) Distance (DIST) is the great circle distance between the present position of the aircraft and the next waypoint or destination.

G. Principal Aircraft Inputs

(1) The true airspeed input signals to the INS from the air data system are used for determination of wind

speed and wind direction. The barometric altitude from the air data system is used for damping the integrating loop which computes altitude. Should the input become unreliable, the INS automatically used a simulated altitude profile, which is selected on the basis of ground speed, in place of the barometric altitude.

The DME systems (Ref. 34-51-00) determine the slant range distance from the airplane to selected DME ground stations by measuring the time it takes a pulse from the DME on board the aircraft to leave the aircraft, reach the ground station and return to the aircraft. This time is directly proportional to the distance between the aircraft and the ground station.

(a) The DME system provides a pair of pulses to the INS, the first pulse corresponding to the transmit pulse and the second pulse corresponding to the reply pulse. The time difference between these two pulses in converted by the INS computer into slant range data.

(b) INS/DME interface (Ref. Fig. 012)

DME 1 receiver is tied to INS 1 navigation unit, and DME 2 receiver is tied to INS 2 navigation unit.

To effect a dual DME solution, DME range information is interchanged between all three navigation units via the intersystem data transfer channels. Each navigation unit receiving valid DME data transmits to the other two navigation units the value of slant range being received along with the latitude, longitude, and altitude of the interrogated DME station. INS 3 is not tied to a DME receiver but receives DME data from the other two systems via the intersystem data transfer channels.

(c) Optimum DME updating occurs when slant range data from two separate DME stations is available. But in many areas, only single DME receiption is available. The INS can make updating calculations with either single or dual DME inputs.

(d) In addition to the DME update capability, the INS has a three system mixing feature which is employed during aided-inertial operation when DME data is not available. When DME data is not available and if there are three INS all operating in the

NAV mode, each INS commanded to do triple INS mixing (MI = 4) will update its present position. Inertial latitude and longitude data from each INS is compared and all three INS select the mid values of each to use as a best estimate of present position. The transition from DME update to the three system mix, and reverse, is smoothed to prevent steering transients.

H. Triple INS Mixing

(1) Triple system mixing is performed during NAV when MI = 4 is commanded, valid position data is being received from the other two systems and DME data is not available. If DME data is available triple mixing will not occur.

(2) Triple system mixing results in all three systems (if all three have MI = 4) being updated to the same latitude and longitude. Only the system commanded to carry out triple mixing will display the updated position, the other two or one system not commanded to carry out a systems mix will display their own latitude and longitude positions.

The mixing is done using direction cosines rather than latitude and longitudes with a bad system being rejected. The use of mid values of latitude and longitude rejects the use of a bad system, whereas the use of an average value of latitude and longitude causes a bad system to have an inordinate effect on the updated value.

(3) The advantages of the three systems mix, other than accuracy, are that all three systems will display the same position dependent information, steer the same course, and issue discretes at the same time. More important a degraded system will not steer a degraded course.

3. INS Interconnections

A. Inertial signals comparator unit (ISCU, Ref 34-46-00) is a safety device whose function is to monitor output information from the three INS. It has two modes of operation.

(1) In cruise mode the comparator monitors Pitch and Roll attitudes of the three INS.

(2) Approach mode is activated below 600 ft. if LAND SELECT condition is in operation and the comparator

monitors vertical acceleration and platform heading in addition to those parameters monitored in cruise mode. The warnings (Primary attitude warning - Platform Heading Warning - True Heading Warning and HSI Warning) are sent to the ISCU in the form of a 28 VDC signal.

B. INS Information Switching (Ref. Fig. 014)

(1) Navigation information

Two horizontal situation indicators (HSI, Ref. 34-23-00) are installed on the aircraft, one on each pilot's instrument panel. The Captainn HSI receives INS navigation information from INS 1 or 2 as selected from the Captain NAV/INS switch. The First Officer HSI receives INS navigation information from INS 2 or 1 as selected from the First Officer NAV/INS switch. The Captain can select INS 1 and the First Officer INS 2, or both can select INS 1. Both can also select INS 2, but the Captain cannot select INS 2 and the First Officer select INS 1 at the same time.

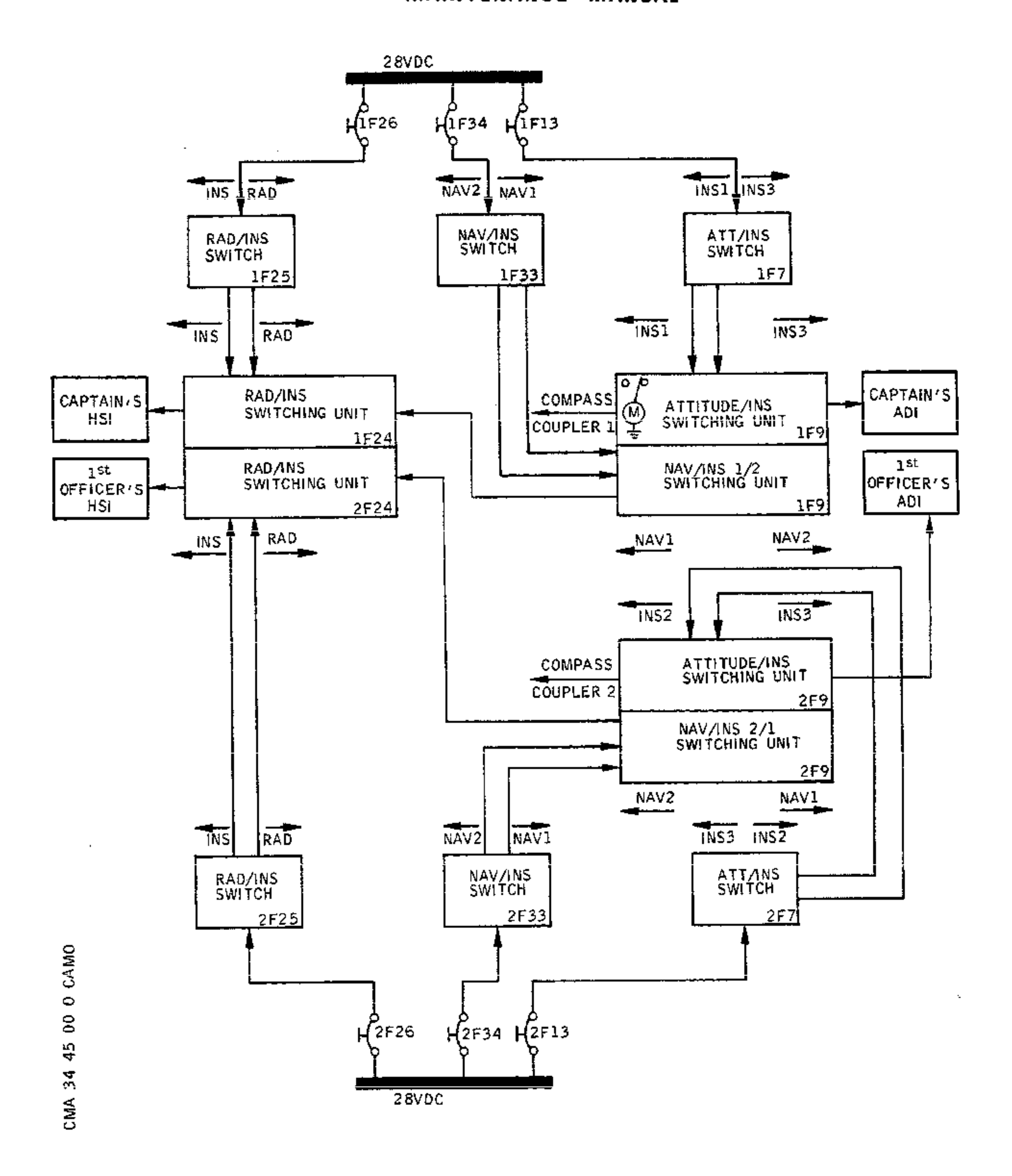
TRUE HEADING, DRIFT ANGLE and TRACK ANGLE ERROR navigation information is distributed by 3 wire synchro.
DISTANCE TO GO and GROUND SPEED information is distributed in digital form.
CROSS TRACK DEVIATION and TO/FROM information and TRUE HEADING WARNING, DIGITAL DATA WARNING and HSI WARNING validities are distributed in the form of 28 VDC signals.

(2) Attitude information

Two attitude director indicators (ADI, Ref. 34-23-00) are installed on the aircraft, one on each pilot's instrument panel. The Captain ADI receives pitch and roll attitude information from INS 1 or 3 as selected by the ATT/INS switch. The First Officer ADI receives pitch and roll information from INS 2 or 3 as selected by the ATT/INS switch.
PITCH and ROLL 2 information is distributed by 3 wire synchro.
AUXILIARY ATTITUDE WARNING validity is distributed in the form of a 28 VDC signal.

C. Weather radar stabilization signals are supplied by the inertial systems. They are hard wired by 3 wire synchro with INS 1 feeding weather radar 1 and INS 2 feeding weather radar 2.

D. The INS is hard wired to the AFCS with INS 1 feeding AFCS 1



Control Switches and Switching Units -
Block Diagram
Figure 014

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and INS 2 feeding AFCS 2.

CROSS TRACK DEVIATION and VERTICAL ACCELERATION navigation information is distributed in voltage form.
PITCH 1, ROLL 1, STEERING and DRIFT ANGLE information and
R B PITCH and ROLL 3 monitoring information is distributed by 2
R B and 3 wire synchro.
AUXILIARY ATTITUDE WARNING and HSI WARNING validities are distributed in the form of 28 VDC signals.

E. The INS is hard wired to the track heading unit (THU, Ref. 34-23-00) with INS 1 feeding the No.1 system and INS 2 feeding the No.2 system.

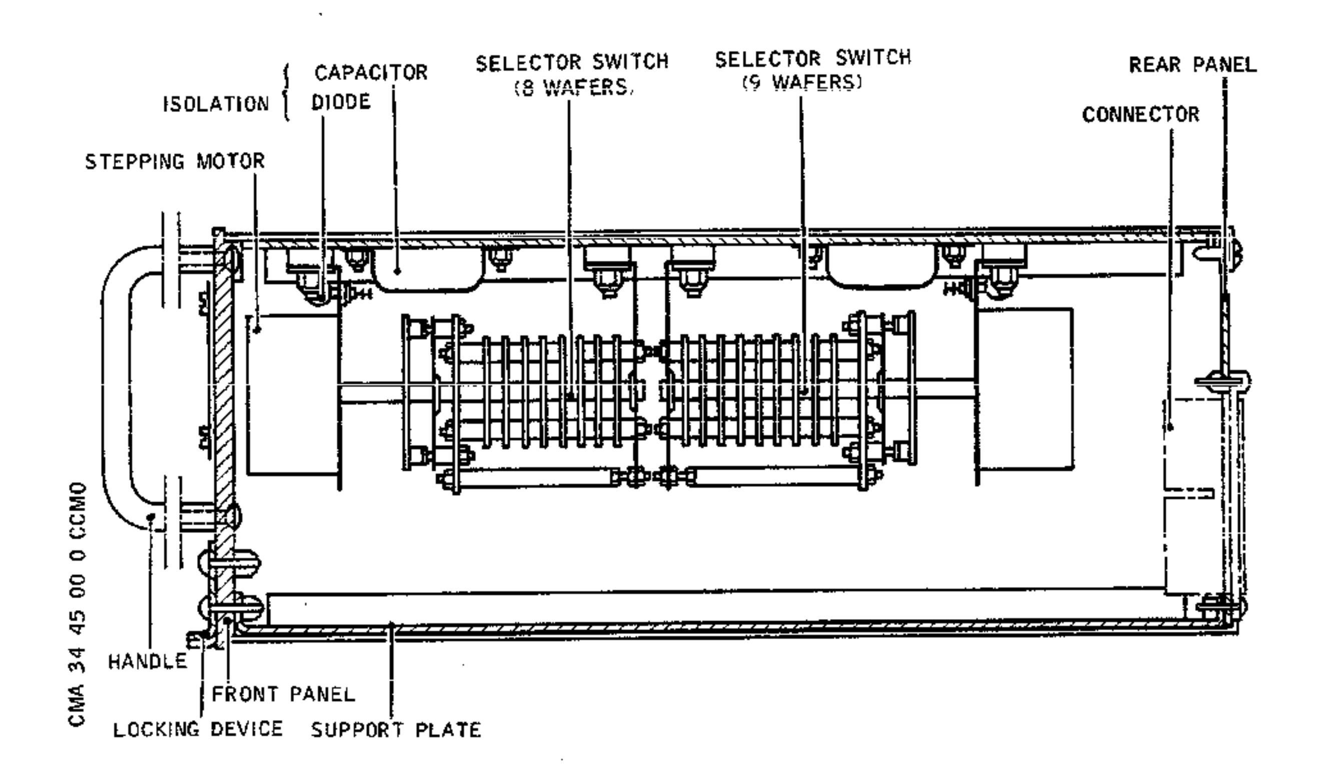
DRIFT ANGLE information is distributed by 3 wire synchro.
HSI WARNING and HEADING WARNING validities are distributed in the form of 28 VDC signals via the monitoring stage of the corresponding HSI.

F. Attitude information to the compass coupler is fed via the ATT/INS switching unit and is controlled by the ATT/INS switch. Compass coupler No.1 receives INS information from INS 1 or 3 and compass coupler No.2 receives INS information from INS 2 or 3.

PLATFORM HEADING and ROLL 4 information is distributed by 3 wire synchro.
CLOCK, SYNCH and DATA (latitude, longitude, ground speed, acceleration along course) information is distributed in digital form.
DIGITAL DATA WARNING, PLATFORM HEADING WARNING and AUXILIARY ATTITUDE WARNING validities are distributed in the form of 28 VDC signals.

G. AEMGP Motor Driven Switching Unit (Ref. Fig. 015)

The switching unit, which weighs less than 2.6 kg, is contained in a rectangular case containing electronics in the upper part, a mounting plate and front and rear panels. A connector on the rear panel is used for unit interconnection with its input/output signal control circuits.
The switching unit switches input signals to one of the two output channels, to be fed to the switched equipment.
Switching of the 8 wafer, 4 circuit, 2 position switching unit selector is carried out by a LEDEX stepper motor.
Switching of the second 9 wafer, 4 circuit, 2 position selector is carried out by a second LEDEX stepper motor.
Each selector is driven separately. The 28 VDC motors are controlled by operation of the Captain and First Officer switches. Each selector is equipped with its own control circuits, wafer power supply and sequential output circuits.



AEMGP Motor Driven Switching Unit
Figure 015

H. Altitude and True Airspeed Information

Each NU receives information from the corresponding ADS in the form of an ADS validity voltage signal, barometric altitude and TAS information by means of synchros.
ADS 1 sends information to NU 3.

I. INS Ground Ventilation Warning

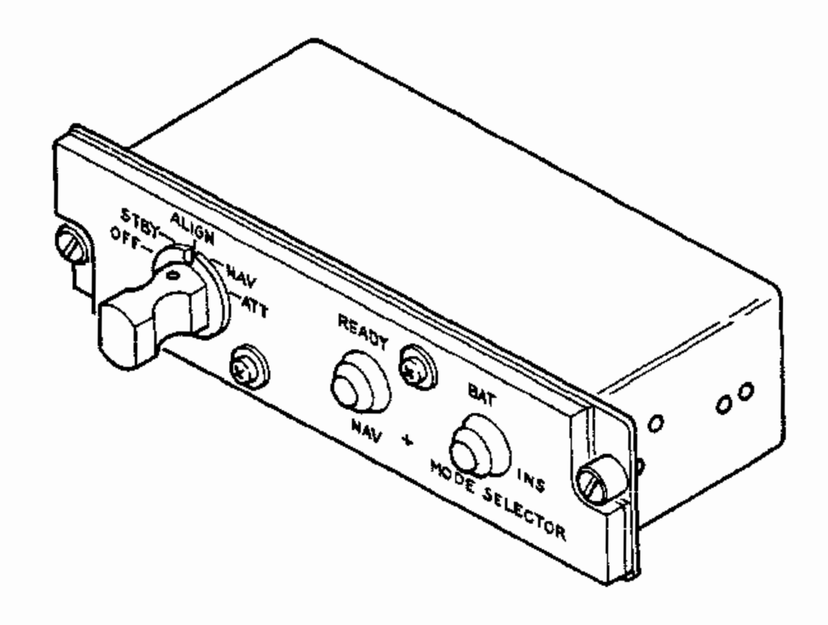
Each NU supplies DIGITAL DATA WARNING to the INS ground ventilation warning circuit.

J. Warnings Sent to Master Warning System

A primary pitch and roll warning output is sent to the master warning system, activating the INS warning on the master warning panel.

4. Mode Selector Unit (MSU) (Ref. Fig. 016)

A. Description



CMA 34 45 00 0 CEMO

MSU Controls and Annunciators
Figure 016

The MSU is contained in a standard case, dimensions 5.75 x 1.5 x 2 in. (14.61 x 4.81 x 5.08 cm), weight approximately 0.66 lb (300 g). It consists of a front panel on which are mounted a 5 position (OFF, STBY, ALIGN, NAV and ATT) wafer mode selector, a green READY NAV indicator light and a red BAT warning light. Interconnection with the NU is made by a connector at the rear.

B. Operation

Mode control is made by switching the auxiliary battery voltage to the NU moding logic by means of the switching unit.

(1) Mode selector in position

OFF : INS not in operation.

STBY : Prepares the INS for automatic alignment.

AC primary power is applied to the system, the fast

heating system and temperature control circuits are activated, battery charging current is available, the platform is erected to aircraft attitude (CAGE mode), the gyroscopes and synchronous motor are started, the computer and CDU are ready to receive data. To enable stabilization temperature and required speeds to be attained, this mode has a time delay of 130 seconds.

ALIGN : Alignment selection activates the computer, which defines from inertial platform the heading of the aircraft with respect to true North and continuously processes accelerometer data. Alignment operation proceeds in 3 phases, coarse alignment, coarse calculation of azimuth, and fine alignment.
During coarse alignment the computer activates a battery test. The INS operates on battery power for a period of 12 seconds to check its capability in operating the system.
This test is indicated by illumination of BAT warning light on the CDU. After a time delay of 2 seconds in ALIGN mode, the discretes PRI ATT WARN, AUX ATT WARN and PLAT HDG WARN are produced by the NU, indicating that ATTITUDE outputs are valid.
Alignment continues and alignment number decreases until the computer causes illumination of READY NAV indicator light. When the mode selector has been placed directly in NAV position, the computer causes momentary illumination of READY NAV indicator light and goes into NAV mode.

NOTE : During alignment procedure, the aircraft must not be moved, but loading, passenger embarkation and refuelling can be carried out.

NAV : Mode selector is in NAV position, the mode is engaged by the computer as described above, the computer receives the discrete signal which authorises initiation of navigation data computation. The computtation loops are modified, the computer must maintain the platform horizontal with respect to aircraft movements in the horizontal and vertical planes and earth rotation rate. It also takes into account instrument drift stored in memory in the form of constants. The results of these computations provide guidance and navigation signals and data displayed on the CDU.

ATT (attitude) : During this mode the INS supplies only attitude information. The computer is not in operation, the CDU remains blank except for WARN and BAT warning lights which remain in operation but not activated. ATT mode can be directly selected on the

ground.
The mode selector switch is fitted with two mechanical stops to avoid inadvertent switching of a mode other than NAV, which causes loss of navigation capability in flight. The stops are released by pulling the mode selector. They are positioned between STBY and ALIGN and between NAV and ATT.

(2) Annunciator lights

READY NAV : illuminates in ALIGN mode when the INS is aligned with sufficient precision, indicating that the mode selector can be advanced to the NAV position. If NAV has been selected in advance, the INS automatically carries out the sequence and READY NAV indicator light momentarily illuminates.

BAT : illuminates when the battery is insufficiently charged or faulty. Illumination of the light indicates automatic shut-down of the INS. When the mode selector is in a position other than OFF, the two READY NAV and BAT lights can be tested by pressing TEST switch on the CDU.

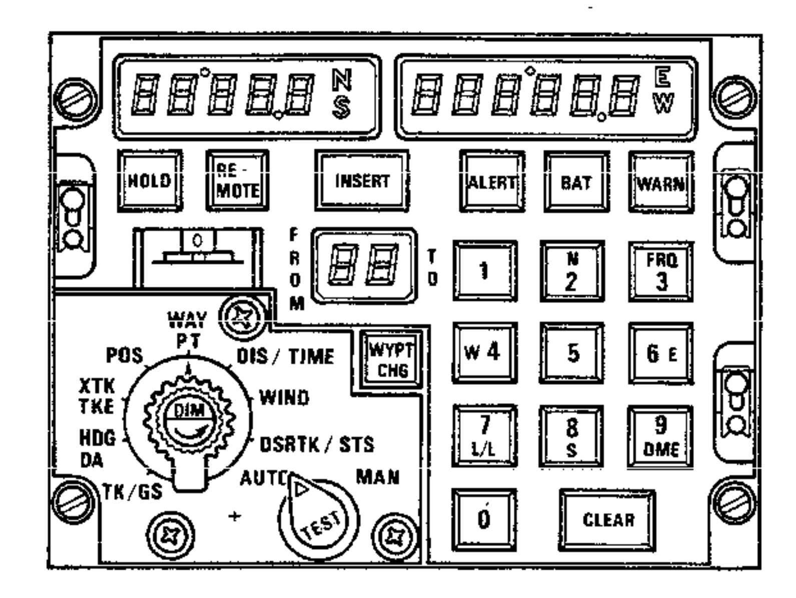
(3) The integral lighting on the front panel is supplied from the aircraft 5 VAC power supply.

5. Control/Display Unit (CDU)(Ref. Fig. 017)

A. Description

The CDU is contained in a rectangular case, 15.18 cm long (excluding connectors) by 14.5 cm wide by 11.12 cm high (5.98 x 5.75 x 4.38 in.). It weighs 1.7 kg (3.9 lb.). The unit has a front panel on which are mounted the data displays, switches, annunciator lights and data loading keyboard. The power supply, 4 electronic cards and connectors are contained in the case. On the front panel are the LH display (latitude) consisting of a 5 digit block and the N/S direction indications, and the RH display (longitude) consisting of a 6 digit block and the EW direction indications. In a row below the displays there are three integrally lighted keys, HOLD, REMOTE and INSERT, and three warning lights, ALERT, BAT and WARN. Under the keys there are a knurled waypoint/DME selector, a FROM-TO display and a WYPT CHG (waypoint change) key. To the right there is a 10 key data insertion keyboard, and below this there is a CLEAR key. In the lower LH corner there are a data selector and an AUTO-MAN/TEST switch.

B. Operation



CMA 34 45 00 0 CGM0

CDU Controls and Annunciators
Figure 017

The CDU displays navigation data, calculated by the NU computer, by means of digital displays according to switching of the data selector. The keyboard enables flight data insertion into the computer. It also displays system operating condition (action code, malfunction code, alignment number, error index and mode index).

(1) Data received

The CDU receives NU computer information in the form of 40-bit words (8 label, 24 data, 8 bits delay time). The bits are channelled into three registers under clock control where they are decoded and used to drive the displays or transmit discrete signals and data to the computer by means of registers 1 and 2.

(2) Keyboard : data transmitted

The keyboard consists of 10 keys which are used to load data into the data displays and FROM-TO display. The N, S, W and E on keys 2, 8, 6 and 4 indicate direction

of latitude and longitude. The FRQ, L/L and DME on keys 3, 7 and 9 are associated with the insertion of DME station data. The lettering FRQ, L/L and DME on keys 3, 7 and 9 is useful but not mandatory, therefore, CIV CDU's can be used with CIV-A systems. Keyboard illumination is controlled by a cabin lighting control.

Keyboard data is coded and fed to the computer via register 4 (20 bits) which stores discrete commands. Each 30 seconds the register is unloaded into the computer.

(3) Power supply

Controlled by a discrete signal received by the CDU in all INS modes except ATT (attitude), the + and - 15VDC from the NU is used to generate the + 12.5, - 6 and + 5 VDC power required by the logic circuitry. Illumination of keyboard, panel and CLEAR key is taken from the 5 VAC aircraft supply.

(4) Indicators

(a) HOLD. This key with integral white lighting illuminates when pressed and a computer reply is received.
When HOLD is pressed, the data in the upper displays (present position) is held for comparison with a known position.

(b) REMOTE. This key (momentary action switch) with amber integral lighting illuminates when pressed and when a computer reply is received. When REMOTE key is pressed it enables simultaneous loading of data into one or both of the other two INS systems providing their respective REMOTE keys have been pressed. The remote operation is disabled when the REMOTE keys are again pressed and the key light extinguishes.

(c) INSERT. This key with integral white lighting illuminates during the initial phase of system start-up or during STBY, indicating that insertion of present position is required by the computer. It also illuminates each time data is inserted from the keyboard, when the first keyboard key is pressed during any other data loading operation. The computer extinguishes the light when the data is loaded or cleared by pressing the CLEAR key.

(d) ALERT. An amber warning light, when illuminated

by the computer, indicates that a waypoint is being approached, either in automatic or manual operation.

(e) BAT. An amber warning light, which indicates when illuminated that the INS system is operating on battery.

(f) WARN. A red warning light, which when illuminated indicates an INS fault or insertion of incorrect data.
It extinguishes automatically when the fault condition disappears. (overridden by alignment procedure or by an action code).
Intermittent out-of-tolerance conditions detected by the navigation unit (NU) illuminate the WARN warning light until it is reset by the TEST switch. If the WARN warning light is illuminated by a continuous condition which does not degrade attitude operation, the WARN warning light extinguishes when the mode selector is placed in ATT position.

(g) The WYPT CHG key is used in conjunction with the keyboard and INSERT key to make a course change. The WYPT CHG key and INSERT key illuminate when pressed the first time. This allows different waypoint numbers to be loaded into the FROM-TO display using the keyboard. Insertion of the different numbers into the digital converter unit (DCU) using the INSERT key causes the WYPT CHG and INSERT key lights to extinguish. If the INSERT key is pressed the computer will use the navigation leg or DME station defined by the new numbers in all navigation computations. Both key lights will also go out when the CLEAR key is pressed.
The WYPT CHG key can also be used to display distance and time (based on present ground speed) between any two geographic locations. When the WYPT CHG key is pressed, the displayed distance and time on the CDU are the distance and time between the two waypoints in the FROM-TO display. Any waypoint numbers, including 0 for present position, can be loaded in the FROM-TO display, but not inserted into the NU, to display distance and time between the two locations. Automatic steering with respect to the originally displayed FROM-TO waypoints is not affected by this procedure. Pressing the CLEAR key restores the displays to normal indications.

(h) CLEAR. This key is used to clear a fault introduced while data is being loaded, to clear the keyboard of data being loaded, or after a CDU mode change.
The numbers in the FROM-TO display indicate either the waypoints defining the navigation leg currently being flown, or the DME station currently being used. The number identifing a DME station flashes in the TO side of the display while the FROM side is blank. Waypoint numbers 0-1 are always displayed at INS turn on. As a flight progresses through waypoints, the FROM-TO display automatically changes to indicate the next navigation leg when a waypoint is reached. The normal automatic sequence is 1 2, 2 3, 3 4 etc. The waypoint sequence can be interrupted at any time by loading different numbers into the FROM-TO display and inserting them into the computer to cause a course change. The number 0 represents a point on one of the navigation legs at which a course change was initiated.

(5) Selectors

(a) The waypoint (waypoint/DME) selector, in conjunction with the WAYPT position of the data selector, allows either waypoints or DME station data to be inserted into the computer memory. During flight, the automatic navigation leg switching by the computer is accomplished in sequence according to the inserted positions from 1 to 9 unless a course change is inserted. The previously inserted latitude and longitude for a waypoint/destination is indicated in the data displays when the waypoint selector is set to waypoint number (1 thru 9) and the data selector is set to WAYPT. The position coordinates displayed when the waypoint thumbwheel selector is set to 0 are normally those of the original departure point inserted at time of alignment. The displayed coordinates can be changed, however, if a course change is made during flight (0 in FROM display) or a position update is performed after landing. The coordinates are changed each time one of the three actions-preflight alignment, course change, or postflight position update is accomplished.

(b) The data selector has eight positions for selecting data to be displayed in the data displays. Three of these positions (POS, WAY PT, and DSRTK/STS) also allow data to be loaded into the

data display and then inserted into the computer memory. The position placarding illumination intensity is controlled by the same cabin lighting control used for the keyboard and CLEAR key.

(b1) Present track angle and ground speed are indicated in the data displays when the mode selector is at NAV and the data selector is set to TK/GS. Present track angle is displayed from 0 to 359.9 degrees in the LH data display to the nearest tenth of a degree with respect to true North. Ground speed is displayed from 0 to 2400 knots in the RH data display to the nearest knot. The displayed value of ground speed is always actual, but actual true heading is displayed in place of present track angle when ground speed is below 75 knots.

(b2) Aircraft heading and drift angle are indicated in the data displays when the mode selector is at NAV and the data selector is set to HDG/DA. Heading is displayed from 0 to 359.9 degrees in the LH data display to the nearest tenth of a degree with respect to true North. Drift Angle is displayed from 0 to 180 degrees right or left of the airplane heading in the RH data display to the nearest degree. The displayed value of heading is always actual, but the displayed drift angle is 0 degrees when ground speed is below 75 knots. The INS will indicate a malfunction if the displayed drift angle is 45 degrees or greater.

(b3) Cross track distance and track angle error are indicated in the data displays when the mode selector is at NAV and the data selector is set to XTK/TKE. Cross track distance is displayed from 0 to 999.9 nautical miles right or left of the desired track in the LH data display to the nearest tenth of a nautical mile. Track angle error is displayed from 0 to 180 degrees right or left of the desired track angle in the RH data display to the nearest degree. The displayed value of cross track distance is always actual, but desired track angle minus heading is displayed in place of track angle error when ground speed is below 75 knots.

(b4) Present position of the aircraft is displayed in the data displays when the data selector is set to POS. Latitude is displayed in the LH data display and longitude is displayed in the RH data display. Both data displays indicate degrees and minutes to the nearest tenth of a minute. This position is also used in inserting present position coordinates during alignment and position updates.

(b5) The WAY PT position, in conjunction with the waypoint/DME selector, allows waypoint and DME station data to be inserted and displayed. Prior to the first insertion after turn-on, the data displays will display 0's for all waypoints, but will display the last DME station data which was inserted during the previous flight. The WAY PT position is also used to display inertial present position. Latitude and longitude are loaded and displayed in degrees and minutes to the nearest tenth of a minute. DME altitude is in feet and is rounded off to the nearest thousand feet. The range is from sea level (0) to 15,000 feet. DME station frequency ranges from 108.00 to 135.00 MHz and is displayed in the format XX°XX.X. For example, a frequency of 117.50 MHz is displayed as 11°75.0.

(b6) Either the distance to any DME station or the distance and time to any waypoint or between any two waypoints can be displayed using the DIS/TIME position. The time is based on the present ground speed. The selection of a DME station for a distance display blanks the time display. Distance is displayed from 0 to 9999 nautical miles in the LH data display to the nearest nautical mile. Time is displayed from 0 to 999.9 minutes in the RH data display to the nearest tenth of a minute. The displayed value of time is 999.9 minutes when ground speed is below 10 knots.

(b7) Wind direction and speed are indicated in the data displays when true airspeed is 115 knots or greater and the data selector is set to WIND. Wind direction is displayed from 0 to 359 degrees in the LH data display to the nearest degree. Wind speed is displayed from

0 to 1300 knots in the RH data display to the nearest knot. Both wind direction and wind speed are indicated at 0 when true airspeed is at the air data set lower stop. An airspeed signal exceeding 1300 knots or a malfunction warning from the air data computer also causes both wind displays to indicate 0.

(6) Control/Display Unit Status (Ref. Fig. 018)
Desired track angle and system status are indicated in the data displays when the data selector is set to DSRTK/STS. Desired track angle is displayed from 0 to 359 degrees to the nearest degree with respect to true North in the LH data display. System status is displayed in the RH data display. During normal operation only three of the six digits are lighted.

(a) The first digit indicates whether the INS is in navigation mode (1) or if it is in either align or standby modes (0).
This digit is a true indication of the INS operating mode and does not necessarily agree with the setting of the mode selector on the MSU. For example, if the mode selector is moved directly from STBY to NAV, this digit will not go from 0 to 1 until the alignment process has been completed and the INS actually enters the navigation mode. Similarly, returning the mode selector to ALIGN after the navigation mode has been entered will not change this digit.

(b) The second and third digits display action or malfunction codes. A new malfunction code (05-56) has been introduced which occurs when the NU is in an 'aided' mode if the raw inertial position differs from the CDU displayed position by more than 3+3T. Terminal error is a function of NU performance and departure and arrival present positions compare to departure and arrival co-ordinates inserted. Thus if an 05-56 and an associated red warn is reported it is possible that there will also be a terminal error greater than 3+3T. If this terminal error only exceeds the 3+3T rate by a small amount, say up to 5NM, and if there are no other malf. codes, then it is recommended that the NU be put into ALIGN and run until ALIGNMENT number is 0. It is then necessary to select NAV and the operation may be repeated to improve NU performance.

(c) The fifth digit indicates the computer mode align-

Control/Display Unit Status
Figure 018

B

ment (Alignment No.) during the align mode. During
B NAV, the number (Accuracy index) will range from
B 1 to 9 and represents the navigation accuracy of
B the INS with 1 (one) being the best accuracy. The
B computer forces the number to 1 when the NAV mode
is entered. As time in NAV increases, the number
progresses toward 9, each increase in number corresponding to 20 mins. NAV time. If a DME update
B is performed, the number decreases toward 1.
B Operationally the A1 Number is useful in evaluating route performance requirements as follows :
B - 5-9 - Pure inertial
B - 4 or less - En route
B - 2 or less - Terminal
B - 1 - Approach

The rate of increase or decrease of the number is dependent on time in NAV, DME station geometry and length of time of DME acquisition. This leads to a conservative estimate of the true performance of the system at any time. If for ins-
B tance, DME aiding has reduced the P1 to 4, the pilot is assured his system is accurate to at least 4NM, and is therefore usable for en-route R/NAV operation. Low values with dual station coverage assures that terminal and approach accuracy numbers have been achieved.

(d) The sixth digit is set to 5 during ALIGN. In NAV, this digit indicates the pilot selected operating MODE INDEX. MI=1 indicates that the INS has had all update removed, an MI=4 indicates that the INS is triple mixing or operating in the aided inertial mode using DME data and an MI=5, that the INS is operating independently but with any previous fix being retained.
During all modes prior to NAV, the sixth digit will display a mode index =5,ie. a display of the desired computer mode number which must be acheived before the NAV mode can be entered, and which cannot be changed whilst in STBY OR ALIGN.

(e) The AUTO-MAN switch is normally left at the AUTO position. This allows automatic navigation leg switching during flight. If the MAN position is used, the INS will not switch to the next navigation leg, but will continue to furnish and display steering signals to maintain the desired track for the completed navigation leg.

(f) The TEST switch, common to the AUTO-MAN switch, is used to test all annunciator lights and dis-

plays and associated circuits, and to reset the malfunction warning circuits in the NU. The TEST switch is also used in conjunction with other controls (DSRTK/STS) to display numerical codes indicating the operating mode of the NU, malfunctions in the system, and recommended action to be taken in response to illumination of the WARN lamp. (Recommended action code as follows):

ACTION CODES	RECOMMENDED ACTION
01	Set mode selector to OFF.
02	Watch data displays for degradation. Select ATT mode if necessary.
03	Check instrument and 26V circuit breakers. One or more analogue outputs are unreliable.
04	Downmode to STBY and restart alignment (ground operation only).
05	Reload nav aid data via ADEU. If unable to load data via ADEU, load data manually via CDU.
B B 06	Verify correct loading of present position

(g) The DIM knob on the data selector is used to vary light intensity of the data displays, the FROM-TO display, the ALERT warning light, and the HOLD, REMOTE, INSERT, and WYPT CHG keys. The DIM knob does not, however, control the BAT or WARN warning lights. The knob is detented to prevent inadvertent dimming of the lamps.

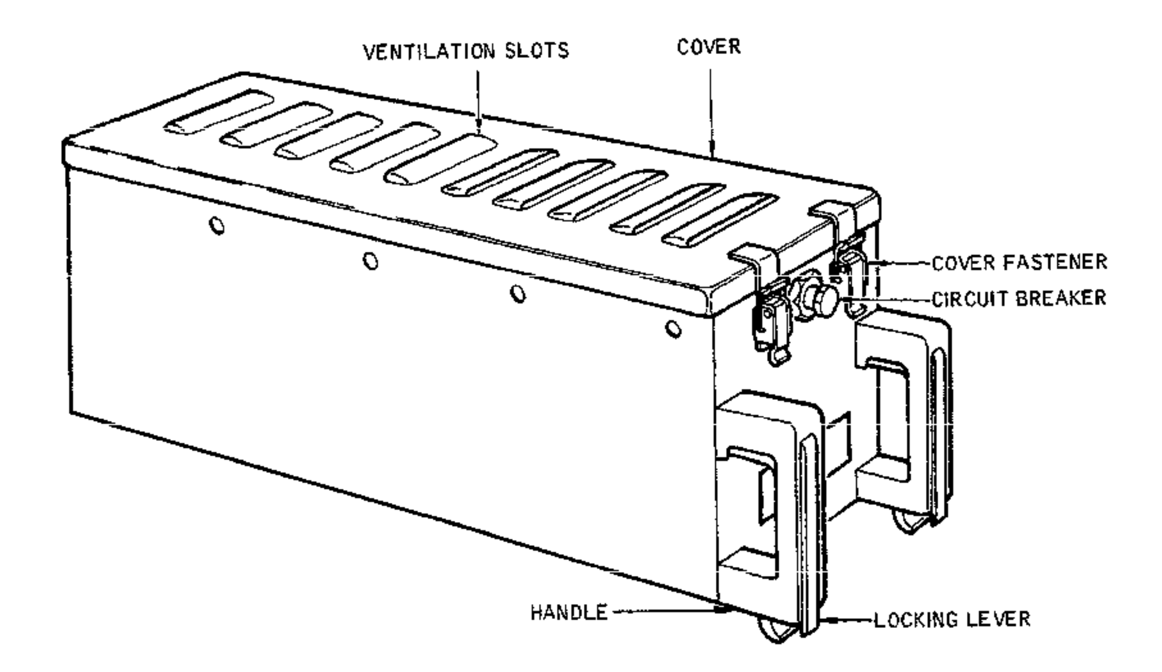
6. Battery Unit (BU)
(Ref. Fig. 019)

R B NOTE : After MOD CM42611, INS No.1 Battery Unit and INS No.2
R B Battery unit are removed and INS No.1 and INS No.2 are
R B connected to aircraft battery A and B respectively.

R The battery unit (BU) provides auxiliary power to initiate INS
R turn on and to supply essential power to maintain INS operation
R when the 115VAC input power is interrupted or drops below the
R required voltage.

A. Description

The BU is made up of 19 cadmium-nickel cells housed in a



CMA 34 45 00 0 CLM0

Battery Unit
Figure 019

1/2 ATR short case designed for rack mounting, dimensions 14.56 x 4.87 x 6.13 in. (36.98 x 12.36 x 15.56 cm), weighing approximately 16.5 lb (7.4 kg).
The top cover, secured to the front panel by two fasteners, is louvered for ventilation. Two locking handles on the front panel are used to secure the case to the rack.
A 20 Ampere circuit breaker is mounted on the front panel.
On the rear panel is a connector for interconnection with the NU.

B. Operation

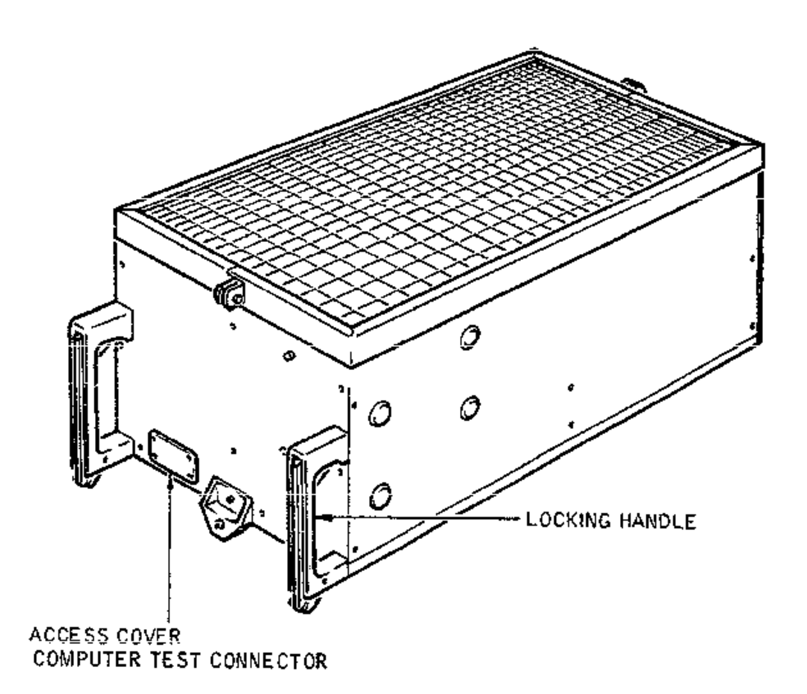
The series-connected cells supply a 24VDC nominal voltage.
The BU is used during the 12 second test period during automatic INS alignment.
The BU provides the voltage necessary for the NU moding logic for application of AC power during system start-up.
As soon as it is power supplied the system provides a battery charging current.
After the initial start-up phase, the BU can provide the auxiliary power necessary for INS operation in the case of temporary 115VAC supply loss.

7. Navigation Unit (NU)
(Ref. Fig. 020)

A. Description

The NU is contained in a 1ATR case, 49.63 cm long by 26.65 cm wide by 21.59 cm high (19.54 x 10.10 x 8.50 in.), weighing 29.54 kg (54.2 lb.). The case is divided into different compartments.
- At the rear, the inertial reference unit (IRU) contains the electromechanics (gyroscopes, accelerometers, motors, synchros and resolvers).
- The inertial reference unit electronics (IRUE) contain power supply, control, moding, conversion, stabilization, frequency signal production and output circuits.
- The digital computer unit (DCU) comprises the input/output stages, the arithmetic unit/instruction processing unit, the memory and timing.

On the front panel these are two locking handles for securing the case to its rack and a computer test socket. Connectors for connection to the aircraft rack are mounted on the rear panel. The unit is ventilated by the aircraft forced air cooling system. The rack is mounted on a table adjustable at 3 points (2 points at the rear, 1 point at the front). These adjustments enable the NU to be set in roll, pitch and heading.



Navigation Unit
Figure 020

B. Operation

(1) The azimuth synchro signal is a direct output to the compass system. This signal represents a constant compass direction but it does not represent a specific compass angle. The pitch and roll signals to the attitude director indicator are direct synchro signal outputs.

(2) The electronics section of the NU includes assemblies which control and convert input power, produce precision frequency signals, charge the battery unit, control temperatures, buffer pitch and roll synchro output signals, amplify stabilization and accelerometer loop signals, and control moding and warning flag signals. The pitch and roll synchro signals are buffered in the gimbal electronics and transmitted to the autopilot and weather radar for stabilization.

Warning flag logic circuits in the electronics section receive signals from the IRU, DCU and other assemblies in the electronics section. The logic circuits control

warning flags in the attitude director indicator and the horizontal situation indicator. The logic circuits also produce a master warning signal for the WARN warning light on the control/display unit.

The electronics section furnishes power, timing and control signals to the IRU and DCU. Horizontal and vertical acceleration signals are processed in the electronics section and transmitted to the DCU.

(3) The DCU of the navigation unit consists of assemblies which make up a digital computer with input/output circuits to perform necessary conversion between analog and digital signals. The latitude and longitude of the waypoints and DME together with DME altitude and frequency are inserted into the DCU using the control/display unit keyboard or ADEU. True airspeed and barometric altitude are signal inputs to the DCU from the air data computer.

The latitude and longitude inputs, air data computer inputs, constants contained in the DCU memory, and inputs from the IRU and electronics are used to continuously solve navigation equations and produce signals for control and display during the NAV mode of operation. The DCU also performs self-tests and comparisons between its output data and the output data of the other INS computers and produces warning signals if tolerances are exceeded.

The DCU output signals are the gyro positions, sent to the electronics section control so that the IRU will be properly oriented with respect to the earth as present position is changed. Mode control, alert and warning flag signal outputs from the DCU are also transmitted to the electronics section.

The DCU computes cross track deviation and track angle error which are transmitted to the autopilot to maintain the airplane on the desired track during automatic navigation. Navigation data signals are transmitted from the DCU to the horizontal situation indicator and the control/display unit for visual displays and to other INS DCU'S for comparison and remote loading.

C. Operating Mode Control

(1) INS Mode Selection

(a) The INS has five major modes of operation which are controlled by the mode selector on the MSU.

The major operating modes are off, standby, alignment, navigation and attitude selected respectively by the OFF, STBY, ALIGN, NAV and ATT positions of the mode selector.
When the INS is turned on for normal operation, the STBY, ALIGN, or NAV position of the mode selector can be selected and the INS will automatically sequence to the completion of the mode selected. The attitude mode can be selected directly during turn on if only attitude signals are desired from the INS. By selecting the ATT position of the mode selector from the OFF position, the INS will sequence through standby operation to the attitude mode.

(b) Downmoding the INS differs from upmoding. Moving the mode selector from NAV to ALIGN during navigation mode of operation will not change the INS operating mode. Downmoding the INS from the navigation mode to the alignment mode can be accomplished by inserting present position after setting the mode selector to STBY and then to ALIGN. This causes the INS to restart the alignment process. However, this should not be done when the aircraft is in motion.

(c) Moving the mode selector to STBY or ATT while the INS is in the alignment or navigation mode of operation will destroy the INS alignment. Selecting the attitude mode shuts off the computer and CDU.

(2) INS Mode Status

(a) Since the system can automatically sequence up to the completion of the mode selected on the mode selector a visual display is provided for determining the status of the INS during the automatic sequence.

(b) The status of the INS can be identified by a series of computer mode numbers which appear in the 5th digit of the RH data display when the data selector is set to DSRTK/STS. During standby, the mode number is 9. As the INS enters alignment, the mode number goes to 8 and decreases toward 0 as successive stages of the alignment process are completed. The mode number will continue to decrease until either the navigation mode is entered or the mode number reaches 0. The navigation mode can be entered any time after the mode number has

reached 5. During attitude mode, the computer and CDU are shut down and no mode number is provided.

(3) OFF Mode

(a) The INS is not functional when the mode selector on the MSU is in the OFF position. The 24-volt battery unit output power is applied to the mode selector to be available at turn-on. The 400 Hz excitation and reference voltages from the aircraft systems are applied to the IRU pitch, outer roll, and platform heading synchros and to the computer digital-to-analog converters when the INS is in the OFF mode. The 115VAC power from the aircraft power system is applied to power relays in the NU which are open when the mode selector is at the OFF position.

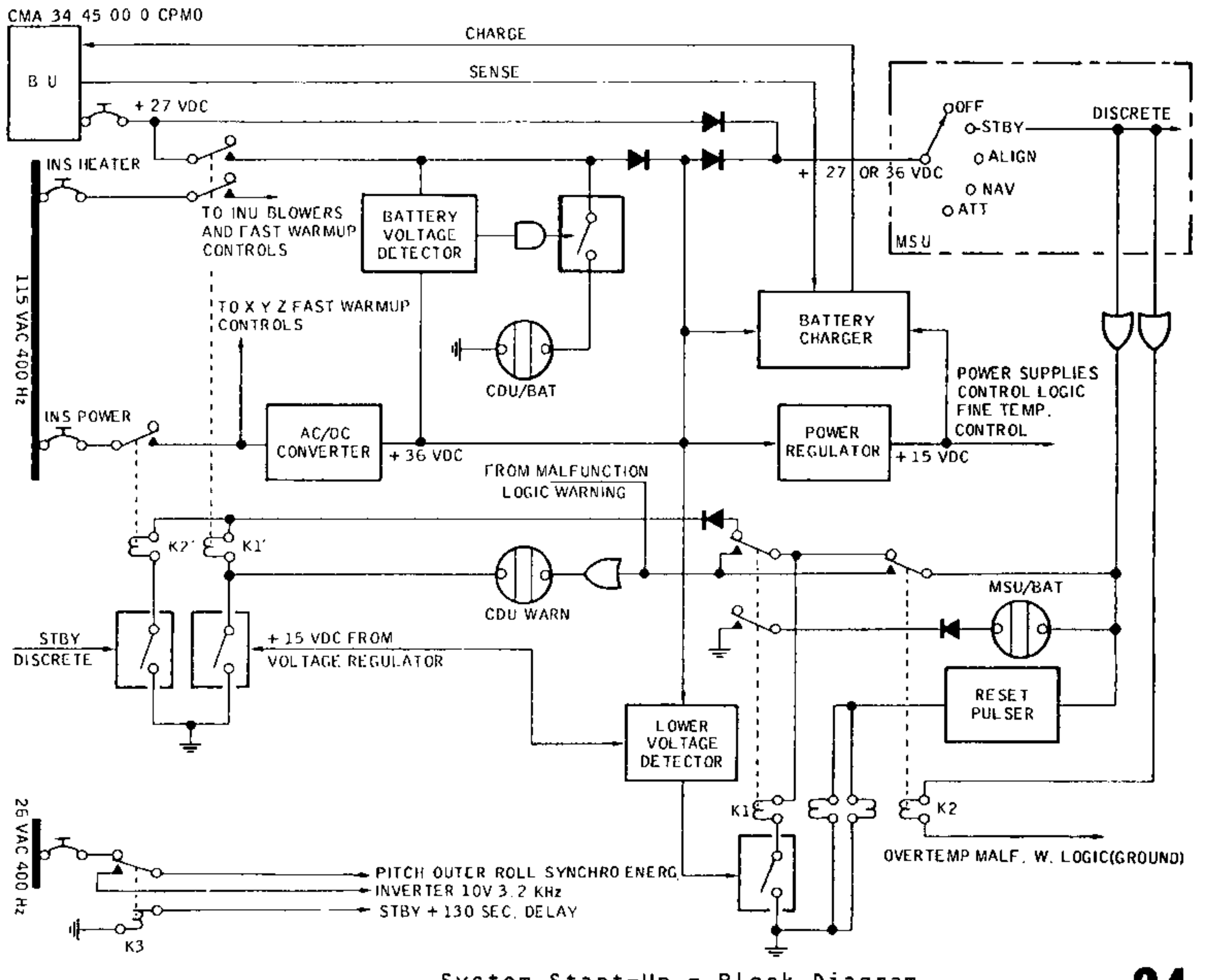
(4) STBY Mode

(a) The standby mode of operation is an optional mode which prepares the INS for automatic alignment, but prevents alignment from being initiated. The standby mode is selected by turning the mode selector on the MSU to STBY. The computer is always in the standby mode when the mode selector is at STBY. This mode is indicated by 9 on the CDU.

(b) During standby operation, the power supplies in the INS are energized, the fast warmup and fine temperature control circuits are enabled, the battery charger is enabled, the gimbal assembly is caged to the aircraft pitch and roll attitude, and the computer and CDU are enabled to allow insertion of data into the computer.

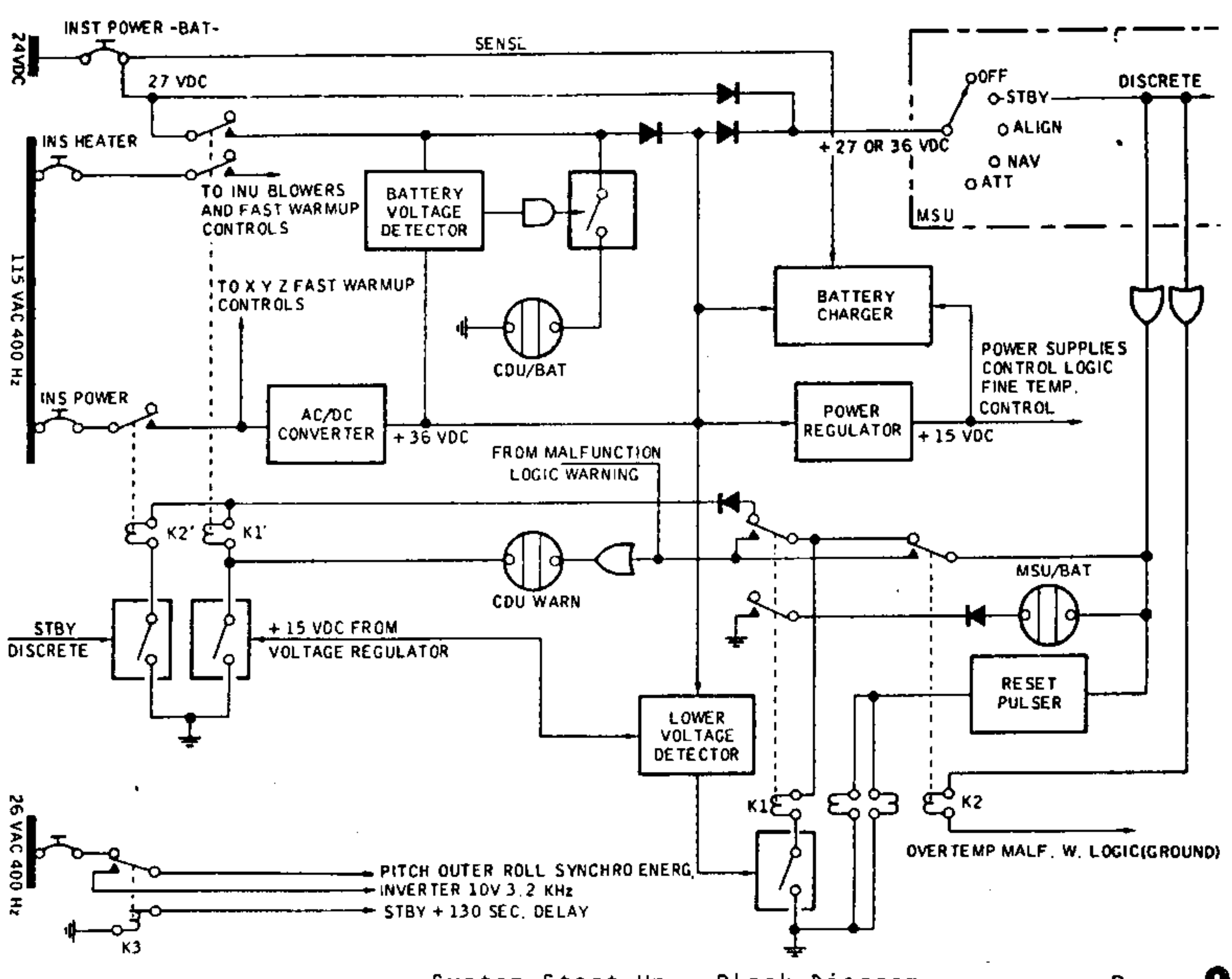
R (5) System start-up (Ref. Fig.021 and 022)

The MSU mode selector in STBY position applies + 27VDC to the NU. The voltage is sent to the Reset Pulser which causes contacts of relays K1 and K2 to close, applying the voltage to coils of power relays K1' and K2'. The battery voltage is also sent to K2' control electronics, energizing K2' which applies 115 VAC 400 Hz to the NU AC/DC converter module. The AC/DC converter supplies 15 VDC which is sent to K1' control electronics which energizes K1'. K1' applies 115 VAC, 400 Hz power to the heating and ventilation circuits of the NU. This sequence avoids overconsumption of the battery during INS start-up.
The AC/DC converter also supplies + 36 VDC which



R

System Start-Up - Block Diagram
Figure 021



System Start-Up - Block Diagram B
(No.1 & No.2 System only) After CM 42611 B
Figure 022

replaces the battery voltage, via an isolating diode, and also supplies the battery charger. The + 36 VDC supplies the Power Regulator which provides the various supplies required by the NU, the computer, CDU and the frequency standard.
In case of interruption of AC power after closing of relay K1', the battery voltage, greater than the AC/DC converter voltage, supplies via its isolation diode, the power required by the INS. BAT warning light illuminates on the CDU.
When the battery voltage falls to 16.5 VDC, the Low Voltage Detector conditions K1 control electronics, which energize K1 whose contacts shut-down the INS. Warning lights WARN on the CDU and BAT on the MSU illuminate until the mode selector on the MSU is placed in the OFF position which enables resetting of the system for a future start-up.

(6) ALIGN Mode

(a) The alignment mode of the INS is entered when the mode selector is set to ALIGN or directly to NAV from OFF or STBY. The alignment mode of operation is necessary to align the inertial instruments in the vertical and horizontal planes, to allow the computer to determine the exact orientation of the airplane with respect to true North, and to allow the computer to determine any changes in accelerometer loop,, gyro torquing, and stabilization loop errors since the last time the INS was operated.

The alignment mode is accomplished by a number of automatic steps identified by the computer mode number. When the mode selector is set to NAV, the alignment of the system progresses through computer modes 9 through 5. The INS starts the navigate mode when computer mode 5 is entered. When the mode selector is set to ALIGN, the alignment of the system progresses through computer modes 9 through 0. The READY NAV indicator light on the MSU comes on when computer mode 5 is reached indicating that the INS can be advanced to the navigation mode. Further refinement of the self-calibration data can be obtained by leaving the INS in ALIGN computer modes 4 through 0. Typical time to reach mode 0 from turn-on is 20 minutes.

(b) Computer Mode 9 (standby or gyro wheel runup).

During computer mode 9, present position and waypoint data can be loaded into the computer. Navigation displays such as heading and track which are dependent on system alignment are not correct and will not be correct until the navigate mode is entered.

The INS remains in mode 9 for a period of 130 seconds which allows time for IRU temperatures to stabilize and insures that gyro wheels attain required speed before platform levelling is started. The computer continues to operate in the standby mode until the 130 second time delay period is completed.

(c) Computer mode 8 (platform coarse levelling)

Platform coarse levelling is started in this mode and is controlled by the computer. During 12 seconds of this mode the battery is tested. Also, during this 12 second period levelling is done by a computer commanded attitude mode. The computer will stay in this mode until the paltform is level enough to start the alignment computations of mode 7. If the time in mode 8 exceeds 5 minutes, the CDU WARN warning light will illuminate indicating that the platform will not level. Present position and waypoint data can also be loaded in this mode. The minimum time in this mode is 51 seconds.

An overtemperature condition in the NU will cause the INS to shut down if the mode selector is set to ALIGN. If the mode selector is set to NAV, an overtemperature will be indicated by the WARN warning light on the CDU illuminating and the malfunction code can also be displayed. The battery unit is not normally tested when platform levelling is accomplished with the mode selector at NAV.

(d) Computer Mode 7 (coarse azimuth determination)

The computer is still trying to level the platform accurately as it did in mode 8 by reading the accelerometer inputs and then developing a torque which drives the gyros towards level.

The system will remain in mode 7 for a minimum of 26 seconds. Entrance to mode 6 is made after the 26 seconds if present position has been loa-

ded. The system will remain in mode 7 until present position is loaded. The total time in modes 7 and 6 will not exceed 8.5 minutes, if present position has been loaded prior to the completion of the 8.5-minute period. The effect of the above may be a very short (26 seconds) mode 7 (present position loaded prior to the 26-second period) or a short mode 6 (one major loop, 0.6 second) if present position loaded after 8.5 minutes in mode 7.

Fine levelling platform alignment is a refinement of the coarse azimuth alignment. The DCU resets all warning discretes and eliminates all malfunction codes stored in memory at the beginning of fine levelling.

(e) Computer Mode 6 (fine levelling)

Computer mode 6 indicates that basic levelling is good and present position has been loaded. The same levelling and computations continue in this mode as in mode 7. The data from the accelerometer is filtered and averaged during modes 7 and 6, and after approximately 8 minutes, has settled enough to advance to mode 5.

(f) Computer Modes 5 through 0

Computer mode 5 indicates all basic alignment computations are accurate enough to advance to the navigate mode. These computations are not stopped but are continuous and the alignment computations continue and improve as long as the system is left in the align mode.

During computer modes 7 or 6 and continuing during computer mode 5, the computer monitors the rotation rate of the azimuth gyro.

As more and more data is accumulated with respect to the rotation rate of the azimuth gyro it is compared to the last known drift rate of this gyro and corrected for the vertical component of earth rotation based on loaded latitude. As this data is accumulated and the results of these computations become smooth the computer mode number is lowered to 4 and below. This indicates that in addition to the heading determination and gyro torquer gain calibration, the azimuth gyro drift rate has also been calibrated and upon entry to the navigate mo-

de all of these terms will be updated.

D. Navigation Mode

(1) The navigation mode takes place when the mode selector is set to NAV but only after the computer alignment number displayed has decreased to 5 or less. When the computer alignment number reaches 5 or less, the computer continously checks for the NAV discrete from the MSU. Once the NAV discrete is present, the computer begins computing navigation data.

(2) Normal inertial operation

During navigation, the INS computer uses the accelerometer output signals to compute navigation and steering information and to develop gyro torquing signals which maintain the IRU oriented to local horizontal. In the navigation mode all acceleration signals are caused by movement of the aircraft.

The computer continously checks input information and computed information for reasonableness. It also receives warning signals from hardware monitors in the IRU and IRUE. If a failure or out-of-tolerance condition is detected by the computer, it provides output signals which will indicate one or more warnings.
The computer will also provide codes to the CDU upon request indicating the recommended action and the failure being detected.

(3) Triple mix and aided inertial operation

Triple mix and aided inertial navigation mode is manually initiated by use of the CDU. An MI number of 4 is loaded in place of the 5 in the last digit of the RH display.
The aided inertial INS depends on access to range data provided by DME equipment. This data is presented to the INS in pulse pair form.
If no DME stations are available, the present positions determined separately by the three INS are mixed and a mid value position is determined and used by those in system in MI = 4.

(4) Error Index

In the NAV mode the alignment number becomes the Error Index. This indicates 0 at NAV selection or 2 if the air data is invalid and goes up 1 point every 20 minutes to a maximum of 9. The 9 indicates 9 miles and

changes at the 3t rate. Its full use is with DME input which will cause it to reduce and give a confidence for arrival accuracy.

E. ATT Mode

The attitude mode of operation is selected by setting the mode selector to ATT. The mode selector must be pulled and turned to enter or exit the ATT position. This mode of operation can be used if navigation and/or steering data signals become inaccurate (indicated by illumination of the WARN warning light and appearance of instrument flags). Setting the mode selector to ATT causes shutdown of the DCU. At the same time, the CDU is disabled except for the BAT and WARN warning lights. Illumination of the WARN warning light during attitude operation will indicate that the attitude output signals are inaccurate and the INS should be shut down. INS navigation reference data is lost once the DCU is shut down, therefore the NAV mode of operation cannot be regained during flight after the ATT mode of operation has been selected.
Shutdown of the DCU in the attitude mode of operation destroys alignment, and the navigation mode of operation cannot be selected until the INS is automatically aligned on the ground. The attitude mode can be selected during ground operation by setting the mode selector directly to ATT from any other position.

F. Functional description, self-test procedures

The TEST switch can be pressed at any time during INS operation to test the annunciator lights and displays on the MSU and CDU and the DCU input/output. Proper operation is indicated by illumination of all annunciator lights and displays while the switch is pressed. Each digit in the FROM-TO display and data displays is lighted to indicate an 8. The directional letters (N S E W) are also lighted in the data displays.

Illumination of the WARN warning light can be caused by either an intermittent or a continuous out of tolerance condition. Pressing the TEST switch while the WARN warning light is illuminated will reset the DCU warning circuits and the WARN warning light will go out if the condition is not persistent. If the WARN warning light remains illuminated, the malfunction persists and may impair system performance.

Pressing and releasing the TEST switch while the data selector is at DSRTK/STS will display any malfunction codes in the second and third digits of the RH data display. When the WARN warning light is illuminated, additional malfunc-

tion codes can be displayed by additional TEST switch operation. If more than one failure is detected by the DCU, each actuation of the TEST switch will display another malfunction code until all current malfunction codes have been displayed. Actuation of the TEST switch after all current malfunction codes have been displayed will cause the two digits to go blank.

The DCU stores a record of all failures, whether intermittent or persistent, from the start of fine levelling in the alignment mode until the next time DCU enters the fine levelling mode. The DCU memory can be interrogated to determine all failures that have occured during this period.

8. R/Nav Annunciators

Whenever an INS is being updated the corresponding (INS 1 or 2) amber annunciator on the Captain or First Officer panels will illuminate. These annunciators are located on sub panel 2-211-4 and sub panel 2-212-3 above the radio altimeter indicator on the Captain and First Officer panels respectively. These annunciators alert the pilot that the associated INS is computing the DME data.

9. Automatic Data Entry Unit (Ref. Fig. 023)

A. Two automatic data entry units (ADEU) are mounted on the aircraft and are located on the centre console 7-211 aft of the CDU's. Each ADEU is hard wired to INS 1 and 2 respectively.

B. The automatic data entry unit has a slot to accept a coded card, an AUX START push-button and two annunciator lights.

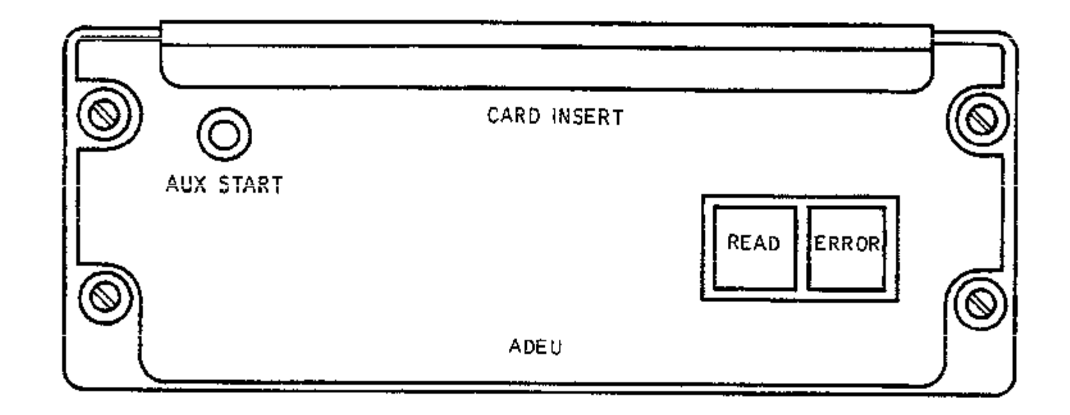
(1) The green READ indicator light illuminates as the card is accepted and extinguishes when reading is complete.

(2) The ERROR warning light illuminates when the ADEU detects a card read error. Before starting another card read operation, the ERROR warning light must be pressed and extinguished.

(3) The AUX START push-button allows the operator to restart the ADEU.

(4) Navaid card (Ref. Fig. 024)

The navaid card is inserted into the slot with the coded side of the card facing fwd and the heavy black line on the left.



CMA 34 45 00 0 CRM0

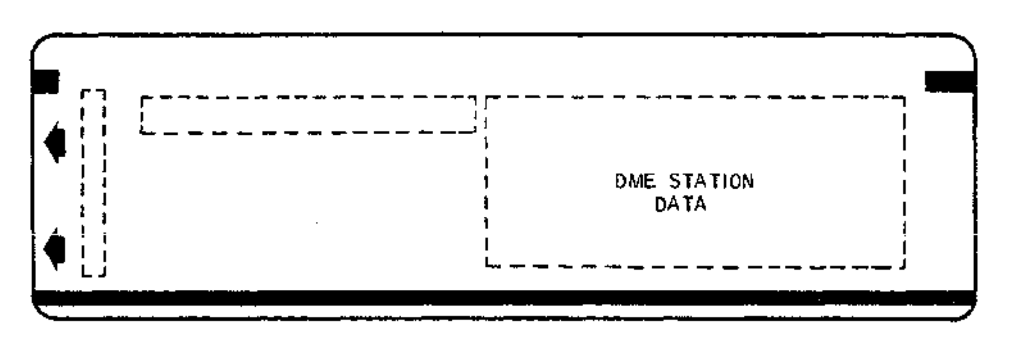
Automatic Data Entry Unit
Figure 023

C. Navaid cards are coded on one side only. The reverse side of the card will identify the information that is coded on the card. The card format will inform the flight crew as to sequence of loaded waypoints, the navaids which should be used to support these waypoints and the time at which the navaids should be used.

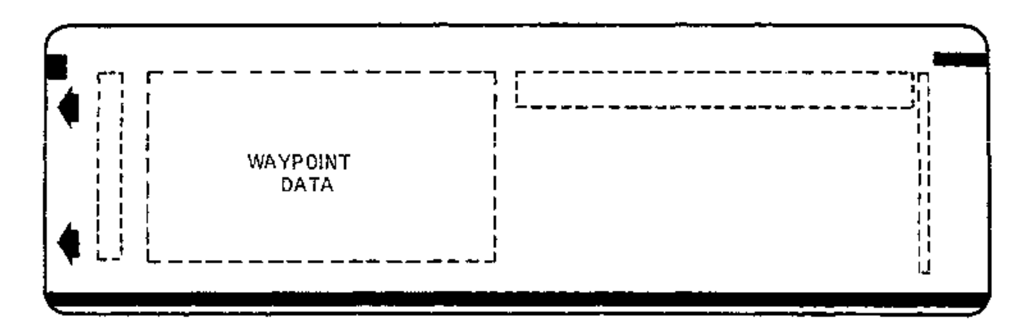
D. The automatic data entry unit provides for optical reading and automatic transmission to the INS of digital data contained on pre-printed or manually marked cards. Data is in optically contrasting marks and spaces representative of binary 'ones' and 'zeros'.

E. The INS will accept data for up to eight waypoint coordinates and up to nine DME stations (co-ordinates, frequency and altitude). Each INS will accept data from only one automatic data entry unit but can retransmit this data to the other INS's using REMOTE loading procedure. Thus one automatic data entry unit can be used to load two or more INS.

F. Typical ADEU Card (Ref. Fig. 025)



a) DME DATA CARD



b) WAYPOINT DATA CARD

CMA 34 45 00 0 CTMO

Typical ADEU Cards (Front) DME Data Card,
WAYPOINT Data Card
Figure 024

Printed in England

LHR _ IAD

WAYPOINT CARD NO.		1 20/ 8/76	
2	LYNEHAM LYNE	CR	N 51 30.5 W 2 0.2
3	ACCEL NAT ACNA	CR	N 51 24.0 W 3 50.0
4	MERLIN MERL	CR	N 51 20.0 W 5 0.0
5	12W WEST BND 12WW	CR	N 50 30.0 W 12 0.0
6	15W WEST BND 15WW	CR	N 50 41.0 W 15 0.0
7	20W WEST BND 20WW	CR	N 50 50.0 W 20 0.0
8	30W WEST BND 30WW	CR	N 50 30.0 W 30 0.0
9	40W WEST BND 40WW	CR	N 49 16.0 W 40 0.0

Select waypt 0 - 1
insert waypt 1 (WOODLEY)
manually then insert this
card before take off.

CMA 34 45 00 0 CVMO

Typical ADEU Card (WYPTS)
Figure 025

The first waypoint data read from the card is stored by the INS as waypoint 'N' where N equals the number in the TO portion of the FROM-TO display plus 1. The next waypoint data group read in stored as N + 1 and so on until the waypoint number is 1 less than the number in the FROM portion of the FROM-TO display. No data is stored as waypoint zero.

G. Typical ADEU Card (Ref. Fig. 026)

Each DME data group on the card has a number assigned from 1 thru 9, depending on which column of the card contains the data. The INS stores each data group by this assigned number, without regard to the number of any DME station that might be tuned in.

H. The binary data on the card is transmitted serially on a binary channel consisting of clock, data and synchro signals to the INS. An automatic data entry unit valid signal (+28 VDC) is received by the INS whenever the automatic data entry unit is functioning correctly.

I. The CDU WARN warning light will illuminate if the data from the ADEU fails a reasonableness test. The data selector on the CDU must be set to DSTRK/STS if the WARN warning light is illuminated. Check that action code 05 with malfunctionn code 55 is present. Malfunction code 55 should be cleared and the card reinserted.

NOTE : Malfunction code 55 may not occur for up to 12 seconds after navaid card is inserted.

★★★★★★★★★★ DME ★★★★★★★★★★

LHR-USA EAST	0	1/10/76
1 114.60 CRK 0 CDRK		N 51 50.4 W 8 29.6
2 114.20 LNZ 0 LANDS END SENN		N 50 3.9 W 5 40.4
3 112.70 YQX 1 GANDER		N 48 54.0 W 54 32.1
4 114.90 YQY 0 SYDNEY		N 46 9.2 W 60 3.4
5 115.10 YHZ 1 HALIFAX		N 44 55.4 W 63 24.2
6 117.70 ACK 0 NANTUCKET		N 41 16.9 W 70 1.6
7 113.60 HTO 0 HAMPTON		N 40 55.1 W 72 19.0
8 115.90 JFK 0 KENNEDY		N 40 38.0 W 73 46.4
9 113.50 AML. 0 ARMEL		N 38 56.1 W 77 28.0

DME UPDATE
No.1 DME - No.1 INS
No.2 DME - No.2 INS
For each of Nos 1 & 2 INS
1. Tune DME
2. Dis/Time
3. WPT sel to DME station number
4. 7 and 9
5. Check DIST = DME dist.
6. WPT/CHG
7. Press DME number on keyboard
8. Insert

FLUSH
1. DSRTK/STS
2. Key 1
3. Insert
4. Key 4
5. Insert

CMA 34 45 00 0 CXMO

Typical ADEU Card (DME)
Figure 026

INERTIAL NAVIGATION SYSTEM - TROUBLE SHOOTING

WARNING: OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified.
The defect can be isolated with the aid of the trouble shooting procedures (Ref. para. 3) and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).
As the 3 systems are similar, trouble shooting procedure is described for system 1 only. For systems 2 and 3 trouble shooting, proceed in a similar manner, replacing the system number by the number in parentheses.
As INS3 does not supply the HSI units, reference to these indicators is ignored during INS3 trouble shooting.

A. Malfunction codes identify INS problems detected during INS self-test. For a specific malfunction code, the malfunction code analysis procedure, INS Status/Malfunction Code display, should be performed. After performing this procedure, an operational test should be performed. If the malfunction code analysis does not clear the trouble, the trouble shooting procedure based on an operational test should be accomplished.
Sometimes a system problem will occur which causes erroneous or fixed data to be displayed on the CDU. As a general guideline, if the problem also gives a CDU red WARN, the fault is almost invariably in the INU which should be changed. If the problem gives no red WARN indication, only the CDU should be changed. If the CDU display and warning lights are blank, the INU should be changed.

The WARN warning light on the CDU provides a master warning for most malfunctions occuring in the INU. Malfunctions occurring in the MSU or CDU are not accompanied by malfunction codes but will normally be obvious because of abnormal indications on display and lights. In general, an abnormal display accompanied by a WARN light indicates an INU malfunction. An abnormal display not accompanied by a WARN light indicates a CDU malfunction.

B. Significance of Action/Malfunction Codes

(1) Loss of Attitude Valid will cause ADI warning flag to come into view. Any of malfunctions 33 through 39 will cause a loss of the Attitude Valid signal from the INS. If any of these malfunctions do not appear in Temporary or Semipermanent Malfunction Record then the problem should not be the INU.

(2) Malfunctions 40, 42, 45 or 60, when appearing in either this entire group or several appearing together would indicate that the system was moved or taxied in ALIGN. Under extreme conditions malfunctions 15 or 16 may appear, but again this would be along with several of the others. A realignment will normally correct these codes. However, if NAV was selected with these malfunctions present, it may take several alignments (and going to NAV each time) to cure them.

(3) Malfunctions 32, 59 and 63 are computer self-check malfunctions. In order to verify the existence of any other problem it is necessary to align the system to at least ALIGNMENT No.8. Until ALIGNMENT No.8 the only other things that can be seen are the stored malfunctions the last time the system was operating. These can be extinguished with the Push to Test and if they were hard failures will not reappear until the computer goes into full operation (ALIGNMENT No.8).

(4) Malfunctions 41, 43 and 45 are checks of the present position that is loaded into the system. Codes 41 and 45 are absolute checks of loaded versus calculated latitude and 43 is a relative check of loaded latitude and longitude between the systems. Malfunction 41 will occur upon entering ALIGNMENT No.6 if the difference between loaded and calculated latitude is greater than 42 minutes. If either of these malfunctions appear, the first thing to check would be loaded latitude. If it is correct, then it is possible that the INU is not calculating latitude correctly. However, if this happens on all of the systems then it is more probably

an incorrect latitude that has been inserted. Malfunction 43 occurs when the loaded latitude or longitude in any of the systems differs by more than 0.7 minutes.

(5) A new malfunction code 05-56 accompanied by a red WARN has been introduced by the 7881710-007 programme. The red WARN will cancel by pressing the AUTO-MAN/TEST switch and "Flight crew action" will be to stay in NAV mode and remove from AP steering.
Malfunction code 05-56 will occur when the INU is in air "aided" mode if the raw inertial position differs from that displayed by the CDU by more than 3 + 3T. If the terminal error exceeds the 3 + 3T rate by a small amount (not greater than 5NM) without any other malfunction code present, then it is recommended that the INU is switched to ALIGN and allowed to reach ALIGNMENT No.0 before switching to NAV. This procedure is to be repeated to improve system performance.

C. Semipermanent Malfunction Record Display

(1) Codes for all malfunctions and out-of-tolerance conditions detected by the CDU are semipermanently recorded for display as they occur. The digital computer unit erases this record and starts a new record each time fine ALIGNMENT No.6 is started.

<u>NOTE</u>: The MSU mode selector should be in STBY position when displaying the semipermanent malfunction record, otherwise fine alignment of the system will take place and erase the memory.

(2) Place data selector in DSRTK/STS position. Observe ALIGNMENT No. and MODE INDEX in RH data display.

(3) Simultaneously press and hold AUTO-MAN/TEST switch and HOLD key. Observe all 8's in FROM-TO and data displays and all lamps and keys illuminated.

(4) Release AUTO-MAN/TEST switch and HOLD key. Observe that malfunction code (13 through 63) appears in RH display.

(5) Press and release AUTO-MAN/TEST switch in sequence and record all malfunction codes until malfunction code display goes blank or reverts to an action code display.

NOTE: The semipermanent malfunction record display can be repeated by rotating the data selector out of DSRTK/STS position then back into DSRTK/STS and repeating steps C.(3) through C.(5).

D. INS Status/Malfunction Code Display

(1) Refer to chart 104.

2. Prepare

A. Switching

Configuration of systems before start up (Ref. 34-45-00, Adjustment/Test).

3. Trouble Shooting

```
***************************************************
* INS1 (2) (3) system start up. Place MSU [1] ([2]  *
* [3]) mode selector in STBY position. By means of  *
* DIM knob on CDU [4] ([5] [6]) vary brightness of  *
* indicators. Place data selector in DSRTK/STS posi- *
* tion. If an action code appears press AUTO-MAN/TEST*
* switch twice to erase it. RH display indicates    *
* 0...95. LH display is clear. IF                   *
***************************************************
      ||   |    ------------------------------------------------
      OK   |-NOT OK--| Action Code remains. Carry out recommended  |
      ||             | operation.                                  |
      ||            ------------------------------------------------
***************************************************
* Place MSU mode selector in ALIGN position. On CDU, *
* INSERT key illuminates, numerals 1-2 appear in    *
* FROM-TO display (0-1 on 7881710-007 prog.), RH    *
* display is 0---85, BAT warning light illuminates  *
* for one 12 second period. IF                      *
***************************************************
      ||   |    ------------------------------------------------
      OK   |-NOT OK--| BAT warning light on MSU illumin-           |
      ||             | ates simultaneously. Replace INS            |
      ||             | batteries on systems [16] ([17] [18]).      |
R  B  ||             | NOTE : After Mod CM 42611, INS No.1 Battery |
R  B  ||             |        unit [16] and INS No.2 Battery Unit  |
R  B  ||             |        [17] are removed and INS No.1 and INS|
R  B  ||             |        No.2 are connected to aircraft battery|
R  B  ||             |        A and B respectively.                |
      ||            ------------------------------------------------
---------------------------------------------------
| G flag on ADI in operation disappears. Check    |
| sphere erection. IF                             |
---------------------------------------------------
      ||   |    ------------------------------------------------
      OK   |-NOT OK--| G flag remains visible. No erection of sphere |
      ||             | on ADI. Ref. Chart 101.                     |
      ||            ------------------------------------------------
R
```

```
*****************************************************
* System test (AP not engaged). Place CDU data selec-*
* tor in POS position. Press and hold AUTO-MAN/TEST  *
* switch : LH display indicates 88° 88.8 N/S, RH dis-*
* play indicates 888° 88.8 E/W. TO/FROM display indi-*
* cates 88. HOLD, REMOTE, INSERT and WPT CHG keys and*
* ALERT, BAT and WARN warning lights illuminate. IF  *
*****************************************************
     ||   |           ----------------------------------------------
     OK   |-NOT OK--| Replace CDU [4] ([5] [6])                    |
     ||   |           ----------------------------------------------
     ||   |
     ||   |           ----------------------------------------------
     ||   |-NOT OK--| Replace INU [7] ([8] [9])                    |
     ||               ----------------------------------------------
-----------------------------------------------------
| BAT and READY NAV indicator lights on MSU are      |
| simultaneously illuminated. System is still        |
| in TEST configuration.                             |
-----------------------------------------------------
     ||   |           ----------------------------------------------
     OK   |-NOT OK--| Replace faulty indicator light               |
     ||   |         | or : Replace MSU [1] ([2] [3])               |
     ||   |           ----------------------------------------------
     ||   |           ----------------------------------------------
     ||   |-NOT OK--| Replace INU [7] ([8] [9])                    |
     ||               ----------------------------------------------
-----------------------------------------------------
| TEST configuration on HSIs : Captain and First     |
| Officer NAV/INS switches are in INS1 (INS2) posi-  |
| tion. System is still in test configuration :      |
| heading is 0°, desired track is 0°, drift is 0°,   |
| lateral deviation bar indicates 1 point to right,  |
| NAV & HDG flags are not visible, LIN marker is     |
| visible, MILES counter displays 0888, GND SPD coun-|
| ter displays 300 kt (7881710-007 prog.). IF        |
-----------------------------------------------------
     ||   |           ----------------------------------------------
     OK   |-NOT OK--| TEST configuration incorrect on HSIS. HDG    |
     ||             | flag remains visible.                        |
     ||             | Ref Chart 102.                               |
     ||               ----------------------------------------------
     ||
     ||
     ||
```

R

```
****************************************************
* Insertion of present position : place AUTO-MAN/    *
* TEST switch on CDU in MAN position and data selec- *
* tor in POS position. On data keyboard press N or S.*
* Press keys in appropriate order to insert latitude *
* and press INSERT key. Read latitude in LH display. *
* Repeat operation to insert longitude. Coordinates  *
* are displayed in LH and RH displays on CDU. IF     *
****************************************************
    ||   |                ----------------------------------------------
    OK   |-NOT OK--| Incorrect insertion of present position          |
    ||             | Ref Chart 103.                                   |
    ||                ----------------------------------------------
----------------------------------------------------
| Place data selector in DSRTK/STS position.        |
| Alignment proceeds, indicated by a reducing ALIGN- |
| MENT No.. IF                                      |
----------------------------------------------------
    ||   |                ----------------------------------------------
    OK   |-NOT OK--| WARN warning light illuminates on CDU. Action    |
    ||             | codes appear.                                    |
    ||             | Ref Chart 104.                                   |
    ||                ----------------------------------------------
----------------------------------------------------
| At ALIGNT No.5 READY NAV indicator light on MSU   |
| illuminates, indicating alignment is complete.    |
| ALIGNT No. continues to decrease. Place MSU mode  |
| selector in NAV position. On HSI, HDG flag        |
| disappears indicating heading information is      |
| valid ; LIN marker is visible. First digit of RH  |
| display on CDU is 1.                              |
----------------------------------------------------
    ||   |                ----------------------------------------------
    OK   |-NOT OK--| Alignment not correct, Ref. Chart 105            |
    ||                ----------------------------------------------
    ||
    ||
```

EFFECTIVITY: ALL

BA

R

```
***************************************************
* Introduction of waypoints. (Waypoint must not be   *
* inserted when number 0 is selected in FROM-TO      *
* display).                                          *
* On CDU: place data selector in WAYPT position.     *
* Select waypoint 1 which is indicated in FROM/TO    *
* display. Insert WPT1 coordinates. (Procedure simi- *
* lar to insertion of Present Position).             *
* Coordinates are indicated on data displays. Select *
* WPT2 and 3 coordinates. IF                         *
***************************************************
    ||   |          ---------------------------------------------------
    OK   |-NOT OK--| Waypoint insertion incorrect                     |
    ||             | Ref. Chart 106                                   |
    ||              ---------------------------------------------------
***************************************************
* NAV mode operation: Crosstrack deviation XTK,      *
* Selection of track leg 1-2. Press WAYPT CHG key    *
* which illuminates as well as INSERT key. Insert 1-2*
* on keyboard. 1-2 appears in FROM-TO display. Press *
* INSERT key. WYPT CHG and INSERT push-buttons extin-*
* guish. Place data selector in XTK/TKE position. LH *
* display indicates L or R preceded by deviation in  *
* NM to within ± 0.1. On HSIs, lateral deviation bars*
* indicate same values (1 point = 3.75 NM). LIN      *
* marker is visible. IF                              *
***************************************************
    ||   |          ---------------------------------------------------
    OK   |-NOT OK--| XTK incorrect                                    |
    ||             | Ref. Chart 107                                   |
    ||              ---------------------------------------------------
    ||
    ||
    ||
    ||
```

R

```
*****************************************************
* Place data selector in DSRTK/STS position. LH dis- *
* play indicates desired track angle. On HSIs desired*
* track pointers indicate similar values. IF         *
*****************************************************
    ||   |         ------------------------------------------------
    OK   |-NOT OK--| DSRTK is incorrect                            |
    ||             | Ref. Chart 108                                |
    ||             ------------------------------------------------
    ||
*****************************************************
* Selection of track leg 2-1 (Procedure similar to   *
* 1-2). Place data selector in XTK/TKE position.     *
* LH display indicates R or L preceded by the devia- *
* tion in NM to within ±0.1. On HSIs, lateral devia- *
* tion bars indicate similar values. LIN marker is   *
* visible. IF                                        *
*****************************************************
    ||   |         ------------------------------------------------
    OK   |-NOT OK--| XTK incorrect                                 |
    ||             | Ref. Chart 107                                |
    ||             ------------------------------------------------
*****************************************************
* Place data selector in DSRTK/STS position. LH dis- *
* display indicates desired track angle. On the HSIs *
* desired track pointers indicate similar values. IF *
*****************************************************
    ||   |         ------------------------------------------------
    OK   |-NOT OK--| DSRTK is incorrect                            |
    ||             | Ref. Chart 108                                |
    ||             ------------------------------------------------
*****************************************************
* Selection of track leg 0-3 (Procedure similar to   *
* 1-2). Place data selector in DIST/TIME position.   *
* LH display indicates distance to within ± 1 NM.    *
* On HSIs, MILES counters indicate similar distances.*
* IF                                                 *
*****************************************************
    ||   |         ------------------------------------------------
    OK   |-NOT OK--| Distance is incorrect                         |
    ||             | Ref. Chart 109                                |
    ||             ------------------------------------------------
    ||
    ||
    ||
    ||
    ||
    ||
```

```
R
   *****************************************************
   * True airspeed check : Place ADC1 (2) TEST selector *
   * switch in 1 position. On CDU [4] ([5] [6]) place   *
   * data selector in WIND position. Read in RH display *
   * 298 ± 4 kt.                                        *
   *****************************************************
        ||   |       ------------------------------------------
        OK   |-NOT OK--| Replace CDU.                          |
        ||   |       ------------------------------------------
        ||   |
        ||   |       ------------------------------------------
        ||   |-NOT OK--| Replace INU.                          |
        ||           ------------------------------------------
   *****************************************************
   * Battery test: Trip circuit breakers [10], [11],    *
   * ([12],[13]), ([14],[15]). On CDU BAT warning light *
   * illuminates. System continues to operate normally. *
   * BAT warning light on MSU remains extinguished.     *
   * Do not operate system on battery for more than     *
   * 5 min. IF                                          *
   *****************************************************
        ||   |
        ||   |       ------------------------------------------
        ||   |         | BAT warning light illuminates on MSU.  |
        OK   |-NOT OK--| System shuts down. WARN warning light  |
        ||             | illuminates on CDU. Replace INS battery|
        ||             | [16], ([17]), ([18]).                  |
R  B    ||             | NOTE : After mod CM 42611, INS No.1 Battery |
R  B    ||             |        unit [16] andINS No.2 Battery unit   |
R  B    ||             |        [17] are removed, and INS No.1 and INS |
R  B    ||             |        No.2 are connected to aircraft battery |
R  B    ||             |        A & B respectively.             |
        ||           ------------------------------------------
        ||
   *****************************************************
   * INS system is operational. Reset circuit breakers  *
   * [10], [11], ([12], [13]), ([14], [15]). Leave      *
   * system in operation to continue Trouble Shooting.  *
   *****************************************************
        ||
        OK
        ||
        ||
        ||
        ||
```

```
R       OK
   ******************************************************
   * Comparison of true headings: (With the 3 systems   *
   * in operation). Place 3 CDU data selectors in HDG   *
   * DA position. Make certain that Captain and First   *
   * Officer NAV INS switches are in 1 and 2 positions  *
   * respectively. Check on HSIs that true headings     *
   * are identical within 2°. On CDUs check that        *
   * headings are identical within 0.5°. IF             *
   ******************************************************
       ||   |        ------------------------------------------------
       OK   |-NOT OK--| Incorrect heading on an HSI only. Replace HSI. |
       ||   |        ------------------------------------------------
       ||   |
       ||   |        ------------------------------------------------
       ||   |-NOT OK--| Incorrect heading on a CDU only. Replace CDU   |
       ||   |        ------------------------------------------------
       ||   |
       ||   |        ------------------------------------------------
       ||   |-NOT OK--| Incorrect heading on HSI and CDU supplied by   |
       ||            | the same system. Replace INU.                  |
       ||            ------------------------------------------------
   ******************************************************
   * Attitude comparison: Captain and First Officer ATT *
   * INS switches are in 1 and 2 positions respective-  *
   * ly. Check on ADIs that attitudes are identical     *
   * within 0.5°. Place Captain ATT INS switch in 3     *
   * position. Check that INS3 attitude is identical    *
   * within 0.5°. Place Captain switch in 1 position,   *
   * place First Officer switch in 3 position, check    *
   * that INS attitude is identical within 0.5°. IF     *
   ******************************************************
       ||   |
       ||   |
       ||   |
       ||   |        ------------------------------------------------
       OK   |-NOT OK--| Comparison between ADIs incorrect              |
       ||            | Ref. Chart 110.                                |
       ||            ------------------------------------------------
       ||
       ||
       ||
       ||
       ||
       ||
       ||
       ||
```

R

```
*****************************************************
* REMOTE operation: Check of simultaneous loading of *
* waypoints (AP not engaged). Load by system 1.       *
* The 3 systems are in operation.                     *
* On CDU1 place data selector in WAYPT position.      *
* Press REMOTE keys, which illuminate on the          *
* 3 CDU. Select WPT1 with DME/waypoint selector.      *
* Insert latitude of WPT1, press INSERT key.          *
* Follow similar procedure for longitude.             *
* Successively insert WPT2 and 3 coordinates in a     *
* similar manner. Wait 5 seconds after insertion      *
* of longitude 3. on CDU2 and 3 place data            *
* selectors in WPT position, select WPT1. Check that  *
* for each WPT inserted on CDU1 the coordinates are   *
* similar on the 3 CDUS. IF                           *
*****************************************************
    ||   |      ------------------------------------------------
    OK   |-NOT OK--| Display incorrect for REMOTE operation.   |
    ||             | Ref. Chart 111                             |
    ||              ------------------------------------------------
*****************************************************
* Continue check of REMOTE operation, load the        *
* 3 waypoints by system 2, then by system 3, follow-  *
* ing the above procedure. IF                         *
*****************************************************
    ||   |      ------------------------------------------------
    OK   |-NOT OK--| Display incorrect                          |
    ||             | Ref. Chart 111                             |
    ||              ------------------------------------------------
    ||
    ||
```

```
R      ||
*******************************************************
* ATT operation: with the three systems in operation.*
* Captain ATT INS-COMP-NAV INS switches are in        *
* 1 position. The corresponding First Officer         *
* switches are in 2 position. Place MSU1 mode sel-    *
* ector in ATT position. CDU1 display extinguishes.   *
* Check that Captain ADI still indicates aircraft     *
* attitude, on Captain HSI HDG and NAV flags are      *
* visible, HDG marker is visible, drift pointer dis-  *
* appears, GND SPD and MILES counters are extin-      *
* guished. INS warning light on master warning panel  *
* illuminates. Press to estinguish. On Captain ins-   *
* trument panel, INS1 warning light on ISCU warning   *
* indicator illuminates. If                           *
*******************************************************
    ||   |         ----------------------------------------------------
    OK   |-NOT OK--| Incorrect attitude on Captain                    |
    ||             | ADI. Replace INU [7].                            |
    ||             ----------------------------------------------------
*******************************************************
* Continue ATT operation check on system 2.           *
* Follow above procedure. Check results on First      *
* Officer ADI and HSI. INS warning light on master    *
* warning panel illuminates. Press to extinguish. On  *
* Captain instrument panel, INS1 warning light on     *
* ISCU warning indicator illuminates. IF              *
*******************************************************
    ||   |         ----------------------------------------------------
    OK   |-NOT OK--| Incorrect attitude on First Officer ADI.         |
    ||             | Replace INU2 [8].                                |
    ||             ----------------------------------------------------
*******************************************************
* Place First Officer ATT INS switch in 3 position.   *
* Place MSU3 mode selector in ATT position. CDU3      *
* display extinguishes. On Captain instrument panel,  *
* INS3 warning light on ISCU warning indicator illu-  *
* minates. INS warning light on master warning panel  *
* illuminates. Press to extinguish.                   *
* Check that First Officer ADI still indicates air-   *
* craft attitude. IF                                  *
*******************************************************
         |         ----------------------------------------------------
         |-NOT OK--| Incorrect attitude on First Officer ADI          |
                   | Replace INU3 [9].                                |
                   ----------------------------------------------------
```

```
*************************************
* G FLAG REMAINS VISIBLE            *
* NO ERECTION OF ADI SPHERE.        *
*************************************
```

Carry out ADI self test. Correct operation.
- NO → Replace ADI [39] ([40]).
- YES → Replace INU [7] ([8] [9]). Correct operation.

Replace INU [7] ([8] [9]). Correct operation.
- NO → Check ATT INS 1/3 switching unit [33] ([34]). 28 VDC at circuit breaker output [37] ([38]).

Check ATT INS 1/3 switching unit [33] ([34]). 28 VDC at circuit breaker output [37] ([38]).
- NO → Replace circuit breaker [37] ([38]).
- YES → Check ATT INS 1/3 or 2/3 switch [35] ([36]). Correct operation.

Check ATT INS 1/3 or 2/3 switch [35] ([36]). Correct operation.
- NO → Replace switch [35] ([36]).
- YES → Replace switching unit [33] ([34]).

Chart 101

```
*************************************
*INCORRECT TEST CONFIGURATION ON HSI*
*UNITS.  HDG FLAG REMAINS VISIBLE   *
*************************************
*************************************
*On both HSIS.                      *--YES--| Replace INU [7], ([8]). |
*************************************
```

- On both HSIS.
  - YES → Replace INU [7], ([8]).
  - NO → On Captain HSI [19].
    - YES → Carry out HSI self test. Correct operation.
      - NO → Replace HSI [19].
      - YES → 1 marker is visible on Captain HSI.
        - NO → Check NAV INS 1/2 switching unit. 28 VDC at output of circuit breaker [21].
          - NO → Replace circuit breaker [21].
          - YES → Check Captain NAV INS switch [23]. Correct operation.
            - NO → Replace switch [23].
            - YES → Replace NAV INS 1/2 switching unit [25].
        - YES → INS marker is visible on Captain HSI.
          - NO → Check RAD INS selector switch [21]. 28 VDC at output of circuit breaker [29].
            - NO → Replace circuit breaker [29].
            - YES → Check switch [31]. Correct operation.
              - YES → Replace RAD INS selector switch [27].
              - NO → Replace switch [31].

Chart 102 (Sheet 1 of 2)

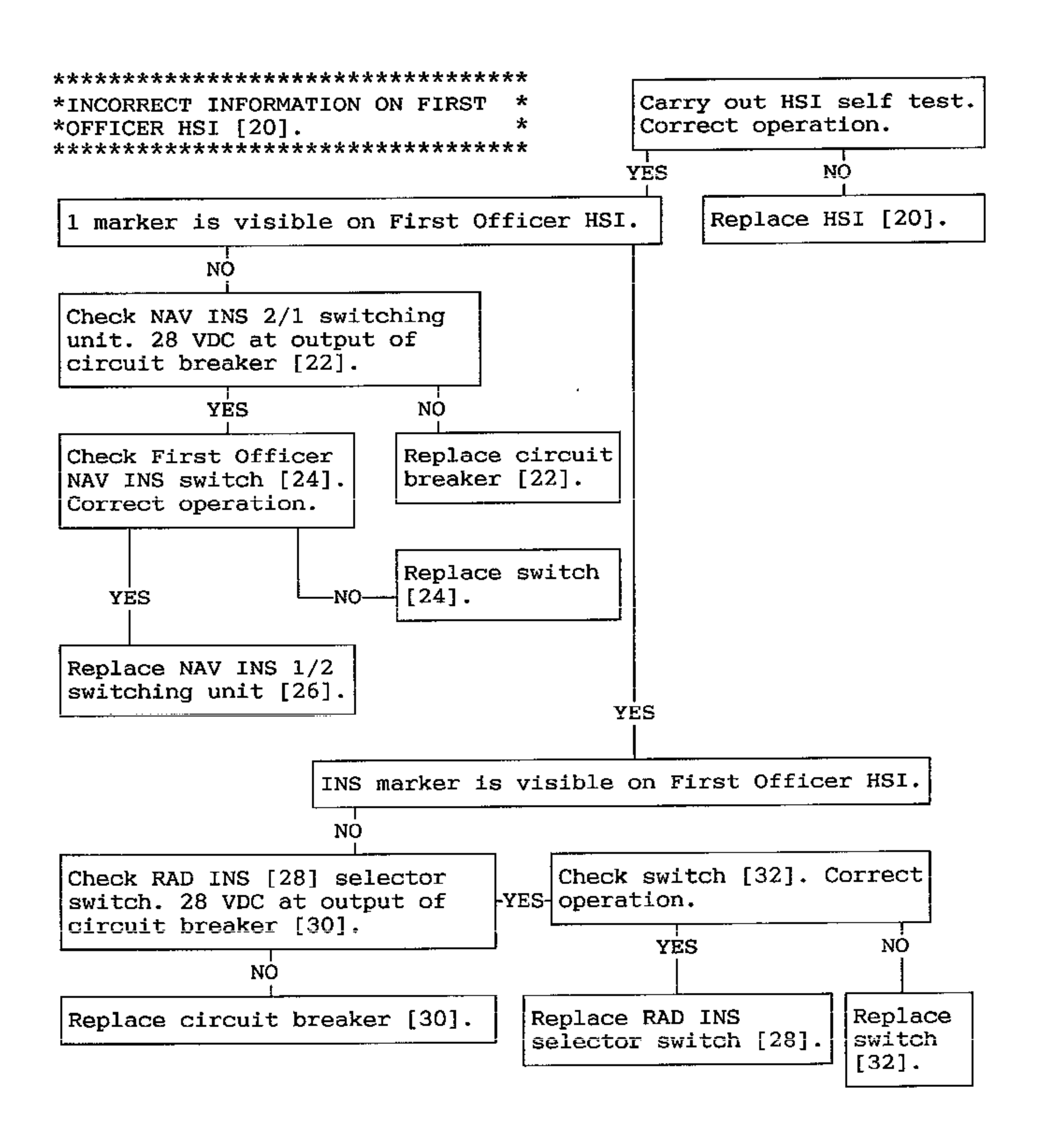


Chart 102 (Sheet 2 of 2)

PRINTED IN ENGLAND

```
************************************
*INCORRECT INSERTION OF PRESENT    *
*POSITION.                         *
************************************
```

Press CLEAR push button and again insert data. Present position remains incorrect.

YES

Replace CDU. Incorrect reading.

YES

Replace INU.

PRINTED IN ENGLAND

Chart 103

```
***********************************
*WARN WARNING LIGHT ON CDU        *
*ILLUMINATES. ACTION CODES APPEAR.*
***********************************
```

Execute recommended ACTION CODE.

ACTION CODE	MALFUNCTION CODE	RECOMMENDED ACTION
01	33, 34, 35, 36	Replace INU.
01	37, 38, 39	Check that ventilation equipment is operative. If OK replace INU.
01	53	Recheck Present Position, if OK, replace INU.
02	13, 14, 31, 32, 42, 59, 63	Replace INU.
02	15, 16, 44, 49, 62	Recycle thru STANDBY and reinsert Present Position. If malfunction doesn't clear, replace INU.
03	22, 23, 24, 25, 26	Check that INST & 26V circuit breakers are closed. If so, replace INU.
04	40, 41, 43, 45, 57, 60, 61, 18	Recycle thru STANDBY and reinsert Present Position. If malfunction doesn't clear, replace INU.
05	18	Requires action code 04.
05	55	Try card again. If action code reverts replace ADEU.
05	56	Accompanied by red WARN (7881710-007 prog). WARN will cancel by pressing AUTO-MAN/TEST switch and flight crew action will be to stay in NAV mode and remove from AP steering.

Chart 104

****
*INCORRECT ALIGNMENT.   *
****

Return to STBY condition. Recommence alignment procedure.

NO

Replace INU.

Chart 105

****
INCORRECT INTRODUCTION OF WAYPOINTS
****

Replace CDU. Correct operation.

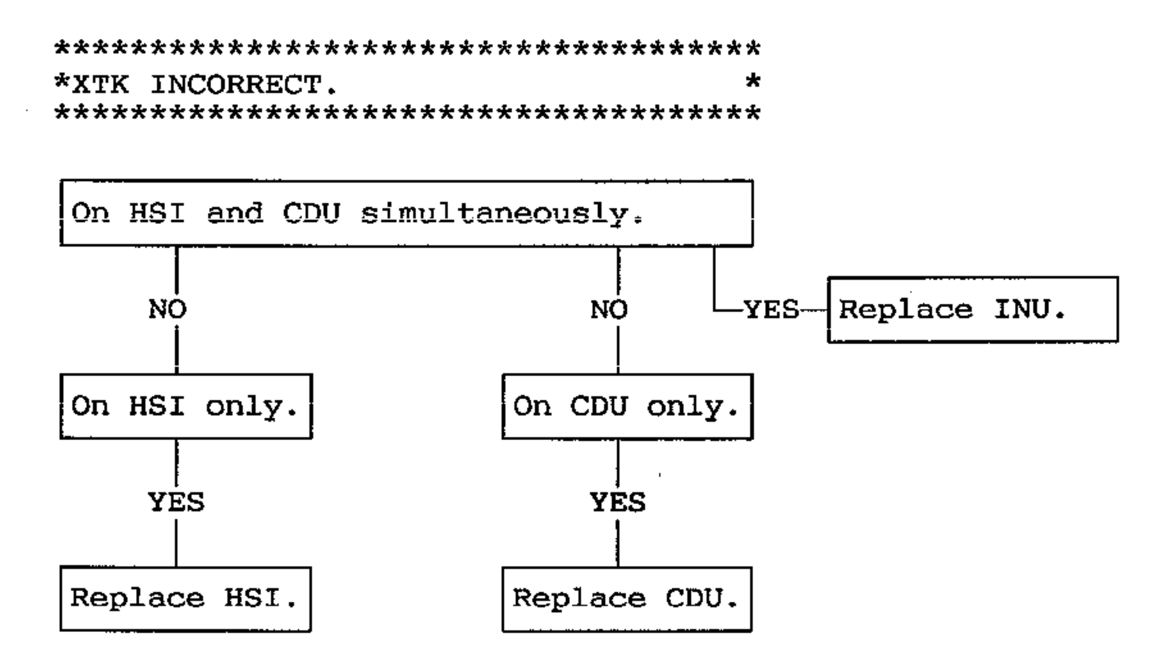
NO

Replace INU.

PRINTED IN ENGLAND

Chart 106

****
*XTK INCORRECT.   *
****



PRINTED IN ENGLAND

Chart 107

```
*************************************
*DSR TK INCORRECT.                  *
*************************************
```

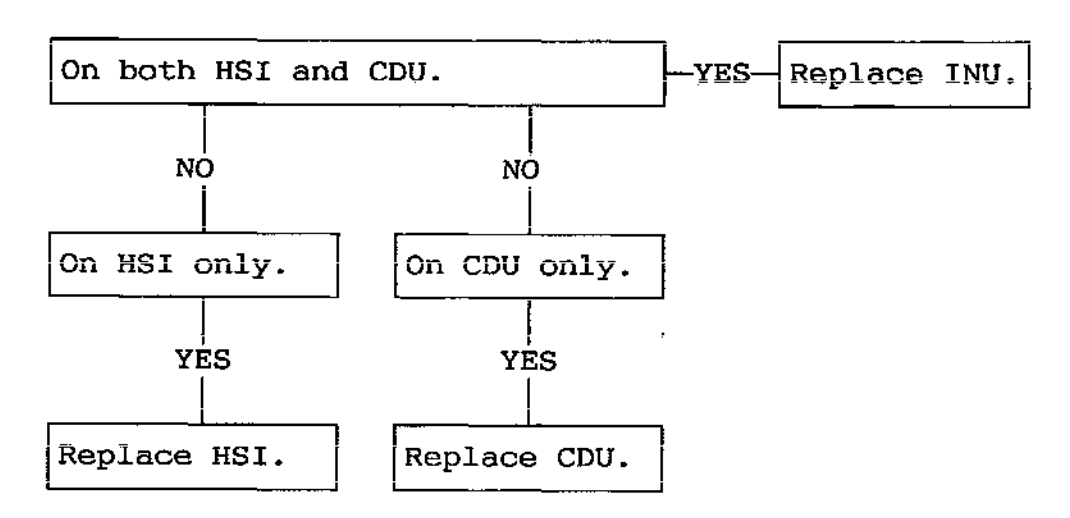
On both HSI and CDU. —YES— Replace INU.

NO → On HSI only. —YES→ Replace HSI.

NO → On CDU only. —YES→ Replace CDU.

Chart 108

```
************************************
*DISTANCE IS INCORRECT.            *
************************************
```



PRINTED IN ENGLAND

Chart 109

```
************************************
*INCORRECT COMPARISON BETWEEN ADIS. *
************************************
```

Switch ADIs successively to INS 3. Difference in readings remains.
YES → Replace ADI.
NO → Replace faulty INU.

Chart 110

****
REMOTE OPERATION, INCORRECT DISPLAY.
****

On both CDUS. —NO— On one CDU only. —YES— Replace faulty receiver CDU. Correct operation.

On both CDUS. — YES → Replace transmitter CDU.

Replace faulty receiver CDU. Correct operation. — NO → Replace corresponding INU.

Chart 111

INTENTIONALLY BLANK

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
[1] MSU1		8-214	1F12	Flt. Cpt	34-45-12	34-45-00
[2] MSU2		8-214	2F12	Flt. Cpt	R/I	34-45-00
[3] MSU3		8-214	3F12	Flt. Cpt		34-45-00
[4] CDU1		7-211	1F11	Flt. Cpt	34-45-13	34-45-00
[5] CDU2		7-211	2F11	Flt. Cpt	R/I	34-45-00
[6] CDU3		9-211	3F11	Flt. Cpt		34-45-00
[7] INU1	Access door	27-123	1F8	Equip.Bays	34-45-34 R/I	34-45-00
[8] INU2	123BB	27-123	2F8	Equip.Bays		34-45-00
[9] INU3	123BB	27-123	3F8	Equip.Bays		34-45-00
[10]INS1 HTR SUP		2-213	1F14	E 6	24-50-00 R/I	34-45-01
[11] INS1 SUP		2-213	1F20	F 6		34-45-01
[12] INS2 HTR SUP		13-216	2F14	G15	24-50-00 R/I	34-45-01
[13] INS2 SUP		13-216	2F20	D14		34-45-01
[14] INS3 HTR SUP		13-215	3F14	C 7	24-50-00 R/I	34-45-01
[15] INS3 SUP		13-215	3F20	A 7		34-45-01
[16] Battery, INS1	Access door	26-123	1F10	Equip.Bays	34-45-38 R/I	34-45-00
[17] Battery, INS2	123BB	26-123	2F10	Equip.Bays		34-45-00
[18] Battery, INS3	123BB	26-123	3F10	Equip.Bays		34-45-00

R B NOTE : After Mod CM 42611, INS No.1 Battery Unit [16] and
R B INS No.2 Battery unit [17] are removed and INS No.1 and INS
R B and INS No.2 are connected to aircraft battery A and B
R B respectively.

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
[19]HSI Captain		2-211	1F22	Flt. Cpt	34-23-11	34-45-05
[20]HSI 1st Officer		2-212	2F22	Flt. Cpt	R/I	34-45-05
[21]NAV INS 1ST PLT SW SUP		1-213	1F34	E15	24-50-00 R/I	34-45-01
[22]NAV INS 2ND PLT SW SUP		15-216	2F34	C 2		34-45-01

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
[23]NAV INS 1/2 Switch		2-211	1F33	Capt. Inst Panel	34-45-17 R/I	34-45-01
[24]NAV INS 2/1 switch		2-212	2F33	F/O Inst. Panel	34-45-17 R/I	34-45-01
[25]NAV INS 1/2 switching unit		26-123	1F 9	Equip. Bay	34-45-35 R/I	34-45-01
[26]NAV INS 2/1 switching unit		26-123	2F 9	Equip. Bay	34-45-35 R/I	34-45-01
[27] RAD/INS selector switch		7-215	1F24	Flt. Cpt	34-23-13 R/I	34-45-05 34-45-01
[28] RAD/INS selector switch		5-216	2F24	Flt. Cpt	34-23-13 R/I	34-45-05 34-45-01
[29]RAD/INS 1ST PLT SW SUP		1-213	1F26	G17	24-50-00 R/I	34-45-01 34-45-05
[30]RAD/INS 2ND SW SUP		15-216	2F26	E21	24-50-00 R/I	34-45-01 34-45-05
[31]RAD/INS switch		5-211	1F25	Flt. Cpt	34-23-17 R/I	34-45-01
[32]RAD/INS switch		5-211	2F25	Flt. Cpt	34-23-17 R/I	34-45-01
[33]ATT INS switching unit		26-123	1F9	Equip. Bay	34-45-35 R/I	34-45-03
[34]ATT INS switching unit		26-123	2F9	Equip. Bay	34-45-35 R/I	34-45-03
[35]ATT INS switch		2-211	1F7	Capt. Inst Panel	34-45-14 R/I	34-45-01
[36]ATT INS switch		2-212	2F7	F/O Inst. Panel	34-45-14 R/I	34-45-01
[37]ATT INS 1ST PLT SW SUP		1-213	1F13	G16	24-50-00 R/I	34-45-01
[38]ATT INS 2ND PLT SW SUP		15-216	2F13	D21	24-50-00 R/I	34-45-01
[39]CAPTAIN ADI		2-211	1F23	Flt. Cpt	34-23-12 R/I	34-45-03

	ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
R	[40]1ST OFFICER ADI		2-212	2F23	Flt. Cpt	34-23-12 R/I	34-45-03

Component Identification
Table 101

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INERTIAL NAVIGATION SYSTEM - MAINTENANCE PRACTICES

R B NOTE: After MOD 34C297 No. 1 and No. 2 ADEU is removed and
R B all references should be ignored.

1. General

A. All aircraft are fitted with Inertial Navigation Units (INU's) to CIV A standard. INU's at this standard will enable Inertial System mixing and DME update. DME update information will be fed into the IN system 1 and 2 via card readers. The 'A' of CIV A is the radio aided (DME update) function.
The CIV A programme provides for three system inertial mixing when DME data is not available. In the three INS system installation the No.3 INU is not tied to a DME receiver but will receive DME data from No.1 and No.2 IN systems via the data highway links.

B. No.1 and 2 Systems
Only CIV A standard INUS P/No. 4BA22230 can be used in 1 and 2 systems.
No. 3 System
Normal INU fit to 3rd system is P/No. 4BA22230.
If P/No. 4BA22230 is not available,

INU P/No.	PROG IDENT
7883450-041	7881710-007
7886580-011	7881710-007

may be used in 3rd system only as a short term measure and subject to the following conditions :

(1) A note to crew must be entered in the tech log stating "Alternative INU fitted to 3rd system will give normal Concorde INS operation but with minor CDU operational differences":

(2) A carried forward defect entry must be made in the tech log to remove the alternative INU and replace it with P/No 4BA22230 also delete the relevant note to crew.

The alternative INUs are programmed to an earlier Concorde standard and will show minor differences in CDU indications.

C. No other INU may be used in No. 3 system without "DEVELOPMENT AUTHORITY"

2. Programme Changes

The latest programme identity has been changed from 7881710-007 to 7881710-010. The following changes will be incorporated.

A. Display Programme Identity

Rotate DSRTK/STS: press hold key.
The programme identity will show in the CDU left hand data display as 10-10 (781710-010).

B. Accuracy Index (A1)

(A1 displayed in NAV. Right hand data display, 2nd digit from the right).
Two minor changes have been made :-

(1) Previously A1 would not go below 2 if barometric altitude was invalid.

This limit has been removed.

(2) The lower value of A1 has been increased from 0 to 1. Operationally the A1 number is useful in evaluating route performance requirements as follows :-

5 - 9	- Pure inertial
4 or less	- En route
2 or less	- Terminal
1	- Approach

C. A new action code 06.
"Verify correct loading of present position", has three malfunction codes associated with it.

(1) 06 - Malfunction code 41 76NM

(2) 06 - MC 43 inter system 0.8NM

(3) 06 - MC 49 manual update 33NM

D. Update Removal

(1) In the -007 programme the mode index remains at "1" after a position update has been eradicated by inserting a mode number of 1.

(2) In the -010 programme the mode index will revert to 5 after inserting a mode number of 1.

(3) Change of action code for 05-56.
(radial distance between the inertial position and the present position displayed on the CDU is greater than 3+3t).

(4) The action code has been changed from 05 to 02 to provide a more meaningful action.

R 3. INS card Readers (ADEU)

R When spare card readers are not available, the following
R procedure enables normal INS operation with one card reader
R serviceable.

R A. Ensure that the serviceable card reader is in No.2 position.

R B. Trip circuit breaker 1F222 CB PNL 15-215.

R C. Fit terminating connector P/No.4-BA22883 to No.1 card
R reader connector (1F154-A).

R D. Enclose the connector assembly in plastic bag and tie to
R adjacent loom.

R E. Fit blanking plate P/No.3-BA22248-104-G.

R F. Functionally test No.2 card reader.

R G. Raise ADD to replace No.1 card reader.

R NOTE : The terminating connector and blanking plate will be
R held in WH15 stores as CM 42609 mod kit.

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00, Servicing).

WARNING : IF DURING TEST, FLOW WARNING LIGHTS ON PANEL 2-214 ILLUMINATE BECAUSE OF A VENTILATION SYSTEM FAULT, SWITCH OFF INS SYSTEMS IMMEDIATELY.

(3) On panel 8-214, make certain that mode selector unit (MSU) mode selectors are in OFF position.

(4) Set the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
MWS SUP 1		W 252	N21
AUDIO WARN SYS SUP 1		W 371	M21
INS COMPTR SUP 2	2-213	F 3	A 6
INS3 26V SUP		3F 30	A 7
HSI TRUE 1ST PLT INS 1 SUP & IND		1F 21	B 6
ADI 1ST PLT INS1 SUP & IND		1F 15	A 7
ADI PLT INS3 SUP & IND		3F 15	A 8
INS1 SUP		1F 14	F 6
INS1 HTR SUP		1F 20	F 6

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
INS COMPTR SUP1		F 4	F 7
FLT CONT & NAV BUS		X 355	H 2
ADC2 28V SUP	5-213	2F 74	F12
FWD FLOW & RH FWD AIR SUP & EXTRT FAN IND		H1187	C 8
REAR FLOW & LH FWD AIR SUP & REAR FAN IND		H1186	C 9
AUDIO WARN SYS SUP 2		W 372	C17
MWS SUP 2		W 251	D15
INS 3 HTR SUP	13-215	3F 20	A 7
INS3 SUP		3F 14	C 7
INS COMPTR SUP3		F 2	B15
ADI 2ND PLT INS2 SUP & IND		2F 15	C13
HSI TRUE 2ND PLT INS 2 SUP & IND		2F 21	C15
INS 2 HTR SUP		2F 20	G15
INS2 SUP		2F 14	D14
R CARD READER 1 SUP	15-215	1F 222	D 5
NAV INST BUS	13-216	X 345	G 4
B NAV/INS 2ND PLT SW SUP	15-216	2F 34	C21
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
R CARD READER 2 SUP		2F 222	E20
GROUND CALL HORN	16-215	H1216	
R BATT A CONTROL		1P 24	
BATT A INDICATION		D 124	

C. INS Operational Test

(1) On panel 5-211, place selector switches
- RAD/INS in INS position.

(2) On Captain instrument panel place switches
- ATT INS1/ATT INS3 in ATT INS 1 position
- NAV INS1/NAV INS2 in NAV INS1 position.

(3) On First Officer instrument panel place switches

- ATT INS2/ATT INS3 in ATT INS2 position
- NAV INS1/NAV INS2 in NAV INS1 position

B - COMP1/COMP2 in COMP2 position.

(4) On both HSI

- INS1, TRUE and HDG indications are visible
- HDG and NAV flags are visible
- G/S flag disappears
- G/S pointer disappears
- TO/FROM arrows are not visible.

(5) On Captain ADI, G flag is visible.
B On RMI/VOR and RMI ADF, compass Flags visible.

(6) On Captain instrument panel, INS1, INS2 and INS3 warning lights on ISCU warning indicator are illuminated.

NOTE : The aircraft must not be towed or taxied during INS alignment. Movements of this type during alignment cause large navigation errors. If the aircraft is moved during alignment, restart alignment by placing mode selector in STBY position then back to ALIGN position, and re-inserting present position. Motion of the type caused by passenger or cargo loading has no effect other than to possibly slow the alignment process slightly.

(7) System 1 start up

On panel 8-214 place MSU1 mode selector in ALIGN position.

On CDU1

(a) INSERT key illuminates.

(b) Numerals 1-2 appear in FROM-TO display (0-1 on 7881710-007 prog).

B (c) Set Data Selector to Pos. Insert present position
B (See system 1 Start up=Functional Test)

B (d) Place data selector in DSRTK/STS position

- check that RH data display is 0---95.
- G and HDG flags are visible on Captain ADI and both HSI.
- BAT warning light on CDU illuminates for one 12 second period during alignment (mode 8).

- on Captain ADI, G flag disappears and ADI drum erects.
B - on captain RMI/ADF and F/O RMI/VOR Compass
B Flags retracted.
B - on both HSI, TO-FROM arrow is visible

(8) System test

B (a) Place data selector away from DSTRK/STS

(b) Place AUTO-MAN/TEST switch in AUTO position.

(c) Press and hold AUTO-MAN/TEST switch

- LH and RH data displays indicate 88°88.8 N/S and 888°88.8 E/W.
- FROM-TO display indicates 88.
- following keys and warning lights illuminate : HOLD, REMOTE, INSERT, WYPT CHG, ALERT, WARN, BAT ;
  On MSU : READY NAV and BAT.
- rotate DIM knob and observe that intensity of data displays, FROM-TO display, ALERT warning light and HOLD, REMOTE, INSERT and WYPT CHG keys is changed.
- set DIM knob for optimum intensity.
- rotate data selector to various positions and observe that decimal point in LH display (and degree symbol in both displays) shifts position.

(d) On both HSI

- HDG and NAV flags are out of view.
- heading = 0° on compass card. Drift pointer and desired track pointer are positioned under lubber line.
- cross track deviation bar is positioned one dot to right.
- MILES indicator reads 888.
- GND SPEED indicator reads 300 kt (on 7881710-007 prog.).

B (e) On 2-211 R/NAV illuminates

B (f) Release AUTO-MAN/TEST switch

B (9) Navigation mode

B (a) Set data selector to DSTRK/STS

B (b) At number 55, check MSU-"READY NAV" green light is

B ON.

B (c) Select NAV, and check CDU RH display indicates
B 1-----.

B (d) INS 1 warning indicator on ISCU, Capt. instrument
B panel - extinguished. Both HSI, HDG flags
B retracted, LIN, TRK markers and drift pointer are
B visible.

B (e) Shut down INS 1 by placing MSU 1 to OFF. INS 1
B warning indicator on ISCU Captains instrument
B panel illuminates. INS warning light on master
B warning panel illuminates, gong sounds. Press
B to extinguish INS warning light.

B (f) Set Captains and F/O ATT/INS, COMP 1/COMP 2.
B NAV/INS switches to their outboard positions.

B (10) System 2 start-up

(a) On Captain and First Officer instrument panels place switches
- NAV INS1/NAV INS2 in NAV INS2 position.

(b) On both HSI

- check presence of 2 indication in place of 1.
B - the other indications are identical with
B those described for system 1.

B (c) Read First Officer ADI in place of Captains ADI.

B (d) On both RMI/VOR RMI/ADF, compass flags are visible

B (e) Repeat tests described for system 1 (Ref. 1. C.
B (7)). Replace MSU1 by MSU2, CDU1 by CDU2.
B - Replace Captain RMI/ADF by F/O RMI/ADF and F/O
B RMI/VOR by Capt. RMI/VOR.

B (f) Repeat "system display test" described for system
B 1 but replace '2-211' in by 2-212.

B (g) Repeat "NAV mode" test described for system 1 but
B replace 'INS 1' in (c) by 'INS 2'.

B (11) System 3 start-up

(a) On Captain instrument panel place switches

B - COMP1/COMP2 in COMP1 position

- ATT INS1/ATT INS3 in ATT INS3 position.

(b) On First Officer instrument panel place switches

B - COMP1/COMP2 in COMP2 position

- ATT INS2/ATT INS3 in ATT INS3 position.

(c) On both ADI

- G flag is visible.

R B (d) On both RMI/VOR and RMI/ADF, COMPASS flags are
R B visible.

(e) - Repeat test described for system 1 (Ref. 1. c.
B (7)). Replace MSU1 by MSU3, CDU1 by CDU3,
B COMPASS FLAGS on both RMI/VOR and RMI/ADF are
B retracted in (d).

B (f) Repeat "System display test" test described for
B system 1

B - delete R/NAV warning light in (e).

B (g) Repeat "Navigation mode" test described for sys-
B tem 1.

B - replace 'INS 1' by 'INS 3'
B - delete HSI checks

B D. INS Accuracy Check

B To establish INS accuracy the following definitions are
B used.

B (1) Terminal Error :- is the error in nautical miles that
B can be displayed on the CDU which represents the dif-
B ference between actual ground position and inertial
B computed position at the end of a sector. To display
B terminal error follow procedure in para E.

B (2) Radial Error :- is the Terminal error and DSRTK from
B the INS position to the actual ground position.

B NOTE : Aircrew are required to enter in Sector Defect
B section of Maintenance Log any Radial error
B greater than 3NM/HR. This is for information
B only and may not necessarily require an INU
B change. Calculation of system error is neces-
B sary to determine INU serviceability.

B (3) Time duration of sector is defined for INS purposes as chock to chock time, which is recorded in the aircraft technical maintenance log. It must be considered however, that as soon as the INS Mode Selector is switched to 'NAV' the INS is computing and as this could be as much as 30 minutes before 'chock away' time it would add to the apparent error. Therefore when assessing an INS error that is only marginely greater that 3 + 3T further evaluation would be in order if no previous reports of excessive error were recorded, therefore request examination after next flight.

B (4) System legal tolerance or the maximum system error allowed is defined as 3 + 3T where 'T' equals chock to chock time for the sector.

R B E. Terminal error check

B (1) The terminal error can only be checked provided present position has not been loaded.

B (a) Mode Selector Unit (MSU)

B (a) Mode select switch from OFF to STBY.

B (b) Control Display unit (CDU).

B (b1) Data select switch to WAYPT.

B (b2) WAYPT thumbwheel to WAYPOINT 1.

B (b3) Check that all displays are zero.

B (b4) HOLD, press to light and check that displays change.

B (b5) Data select switch to POS and compare position displayed to present position.

B (2) If NOT the same FLUSH.

B (a) CDU

B (a1) Data select switch to DSRTK/STS and press any key.

B (a2) Press INSERT key.

B (a3) Check the HOLD light goes out and INSERT light remains on.

(3) If the Positions are the same.

(a) CDU

(a1) HOLD, press to estinguish before the next step.

(a2) Data select switch to WAYPT:

(a3) Key LHR coordinants N51282 W275

(a4) INSERT, press and check that INSERT light remains ON. DO NOT load present position.

(a5) Press WAYPT CHG button.

(a6) Key 0 - 1.

(a7) INSERT, press and check that INSERT light remains ON,

(a8) Data select switch to DIST/TIME and read the terminal error in N Miles from the LEFT HAND display.

(4) Examples of tolerance calculations.

(a) Sector time chock to chock = 7 hrs.
Terminal error (from CDU) = 20 N miles
Radial error = 20
----= 2.86-NM/Hr.
7

System tolerance = 3 + 3T
(max allowable) = 3 + (3 X
= 3 + 21
= 24 N miles

In this case the terminal error is less than the system tolerance and therefore the system is serviceable.

(b) Sector time chock to chock = 7 hrs.
Terminal error (from CDU) = 28 N miles
Radial error = 28
----
7 = 4NM/Hr.

NOTE :- This is greater than 3NM/Hr. and will be entered in maintenance log by aircrew.

B System tolerance = 3 + 3T
B (max allowable) = 24 N miles

B In this case the terminal error is greater than
B the system tolerance. The INU must be changed and
B relevant data entered on the red label, including
B sector details, date and amount of error indicated.

B F. Close-up

B (1) Trip the following circuit breakers :

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
B	FLT CONT & NAV BUS	2-213	X 355	H 2
B	NAV INST BUS	13-216	X 345	G 4

B (2) Switch off electronics rack ventilation system
B (Ref. 21-21-00).

B (3) De-energize the aircraft electrical network and
B disconnect electrical ground power unit (Ref. 24-41-00,
B Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

CAUTION : IF DURING TEST, ON PANEL 2-214, FLOW WARNING LIGHTS ILLUMINATE BECAUSE OF A VENTILATION SYSTEM FAILURE, SWITCH OFF INS SYSTEMS IMMEDIATELY.

(3) On panel 8-214, make certain that mode selectors on mode selector unit (MSU) are in OFF position.

(4) Set the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
MWS SUP 1		W 252	N21
AUDIO WARN SYS SUP 1		W 371	M21
AP/FD SYS 1 SUP	2-213	1C 20	C 5
INS COMPTR SUP 2		F 3	A 6
ADI PLTS INS 3 SUP & IND		3F 30	A 7
HSI TRUE 1ST PLT INS 1 SUP & IND		1F 21	B 6
ADI 1ST PLT INS 1 SUP & IND		1F 15	B 7
ADI PLT INS 3 SUP & IND		3F 15	D 7
INS 1 SUP		1F 14	E 6
INS 1 HTR SUP		1F 20	F 6
INS COMPTR SUP 1		F 4	F 7
FLT CONT & NAV BUS		X 355	H 2

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	ADC2 28V SUP	5-213	2F 74	F12
	FWD FLOW & RH FWD AIR SUP & EXTRT FAN IND		H1187	C 8
	REAR FLOW & LH FWD AIR SUP & REAR FAN IND		H1186	C 9
	AUDIO WARN SYS SUP 2		W 372	C17
	MWS SUP 2		W 251	D15
	INS 3 HTR SUP	13-215	3F 20	A 7
	INS 3 SUP		3F 14	C 7
	AP/FD SYS 2 SUP	13-216	2C 20	A17
	INS COMPTR SUP 3		F 2	B15
	ADI 2ND PLT INS 2 SUP & IND		2F 15	C13
	HSI TRUE 2ND PLT INS 2 SUP & IND		2F 21	C15
	INS 2 HTR SUP		2F 20	D14
	INS2 SUP		2F 14	G15
	NAV INST BUS		X 345	G 4
R	CARD READER 1 SUP	15-215	1F 222	D 5
B	NAV/INS 2ND PLT SW SUP	15-216	2F 34	C21
	ATT/INS 2ND PLT SW SUP		2F 13	D21
	RAD/INS 2ND PLT SW SUP		2F 26	E21
R	CARD READER 2 SUP		2F 222	E20
	GROUND CALL HORN	16-215	H1216	
	BATT A CONTROL		1P 24	
	BATT A INDICATION		D 124	

C. Functional Test of INS1

(1) On panel 5-211 place selector switches
- RAD/INS in INS position.

(2) On Captain instrument panel place switches
- ATT INS1/ATT INS3 in ATT INS1 position
- NAV INS1/NAV INS2 in NAV INS1 position.
R B - COMP1/COMP2 in COMP1 position.

(3) On First Officer instrument panel place switches
- ATT INS2/ATT INS3 in ATT INS2 position.
- NAV INS2/NAV INS1 in NAV INS1 position.

R B - COMP1/COMP2 in COMP2 position.

(4) On both HSI
- INS, 1, TRUE and HDG Indications are visible
- HDG and NAV flags are visible
B - G/S flag is out of view
B - G/S pointer is out of view
B - TO/FROM arrows are out of view.

(5) On Captain ADI, G flag is visible.

(6) On Captain instrument panel, INS1, INS2 and INS3 warning lights on ISCU warning indicator are illuminated.
B On both RMI/VOR and RMI/ADF compass flags are visible.

(7) System 1 start-up

On panel 8-214 place MSU1 mode selector in ALIGN position.

On CDU1

(a) INSERT key illuminates

B (b) Numerals 0-1 appear in FROM-TO display

(c) Place data selector in DSRTK/STS position

- check that RH data display is 0---95.
- G and HDG flags are visible on Captain ADI and both HSI.
- BAT warning light on CDU illuminates for one 12 second period during alignment (mode 8).
- on Captain ADI, G flag disappears and ADI drum erects.
- on both HSI, HDG and NAV flags are visible.
B - TO or FROM arrow is visible.

(8) System test

R B (a) Place data selector away from DSTRK/STS

R B (b) Place AUTO-MAN/TEST switch in MAN position.

(c) Press and hold AUTO-MAN/TEST switch

- LH and RH data displays indicate 88°88.8 N/S and 888°88.8 E/W.
- FROM-TO display indicate 88.
- following keys and warning lights illuminate :

HOLD, REMOTE, INSERT, WYPT CHG, ALERT, WARN, BAT ;
On MSU : READY NAV and BAT.
- rotate DIM knot and observe that intensity of data displays, FROM-TO display, ALERT warning light and HOLD, REMOTE, INSERT and WYPT CHG keys is changed.
- set DIM knob for optimum intensity.
- rotate data selector to various positions and observe that decimal point in LH display (and degree symbol in both displays) shifts position.

(d) On both HSI

- HDG and NAV flags are out of view.
- heading = 0° on compass card. Drift pointer and desired track pointer are positioned under lubber line.
- cross track deviation bar is positioned one dot to right.
- MILES indicator reads 888.

B - GND SPD indicator reads 888 Kt.

R B (e) On 2-211, NAV illuminates ON R/NAV panel

R B (f) Release AUTO-MAN/TEST switch.

(9) Insert present position data

(10) Check INS status.

(a) Ensure that data selector is in DSRTK/STS position
- action code is present in 2nd and 3rd digits of RH data display.

(b) Press and release AUTO-MAN/TEST switch
- malfunction code replaces action code in data display.

(c) Record malfunction code.

(d) Repeat steps (b) and (c) until either 2nd and 3rd digits in RH data display go blank and WARN warning light extinguishes, or action code reappers
- if WARN warning light extinguishes and 2nd and 3rd digits go blank, failure was intermittent and has been cleared. INS can resume operation in mode in which INS was operating when WARN warning light illuminated and INS outputs can be used by aircraft system and instruments.

(e) If WARN warning light remains illuminated and action code reappears following last action code comply with action code as follows :

CODE	RECOMMENDED ACTION
BLANK	NORMAL Operation
01	Shut off system, remove for maintenance.
02	NAV performance degraded. Change ATT mode if necessary.
03	Check O/P to HSI and AP (in particular Check 26V 400Hz circuit breakers).
04	Return to StBy position, re-insert present position (ground operation only).
05	Return to OFF position, repeat start-up procedure.

(11) Enter NAV mode.

Alignment is completed when computer enter mode 5 (5th digit on RH data display). READY NAV indicator light on MSU illuminates. Place MSU mode selector in NAV position. Observe that READY NAV indicator light extinguishes, flight instrument warning flags controlled by INS disappear and left-most digit of RH display changes from 0 to 1. Also that INS1 warning light on ISCU warning indicator on Captain's instrument panel extinguishes.

(12) System 2 start-up

(a) On Captain and First Officer instrument panel place switches
- NAV INS1/NAV INS2 in NAV INS2 position.
- ATT IN2/AIT INS3 in ATT INS2 position
- COMP1/COMP2 in COMP2 positon

(b) On both HSI
= observe that 2 indication replaces 1 indication, other information is the same as for system 1.

(c) On both VOR/RMI and ADF/RMI observe that compass flags are visible.

(d) Check that F/OS ADI G Flag is visible.

(e) Read INS2 warning light in place of INS1 warning light on ISCU warning indicator.

(f) On 5-211, selector switches RAD/INS are in INS position.

(g) Repeat test described for system 1 (Ref. Paragraph 2. C. (7 to 11)). Replace MSU1 by MSU2 and CDU1 by CDU2.

- Warn light INS1 by INS2,
- Read compass flags on F/OS ADF/RMI and Captains VOR/RMI are retracted.

(h) On Captain instrument panel, place NAV INS1/NAV INS2 switch in NAV INS1 position.

(13) System 3 start-up

(a) On Captain instrument panel place switches
- ATT INS1/ATT INS3 in ATT INS3 position.
- COMP1/COMP2 in COMP1 position

(b) On First Officer instrument panel place switches
- ATT INS2/ATT INS3 in ATT INS3 position.
- COMP1/COMP2 in COMP2 position

(c) Do not refer to HSI, which are not supplied by INS3.

(d) On both ADI
- G flag is visible.

(e) On both ADF/RMI and VOR/RMI compass flag are visible

(f) Read INS3 warning light on ISCU warning indicator in place of INS1 warning light.

(g) On 5-211 selector switches RAD/INS Captain and F/O are in INS position

(h) Repeat test described for system 1 (Ref. Paragraph 2. C. (7 to 11)).
Replace MSU1 by MSU3 and CDU1 by CDU3, warning light INS1 by INS3.

NOTE : INS3 does not send data to HSI.

B (i) Place Captain and First Officer ATT INS switches in ATT INS1 and ATT INS2 positions respectively.

(14) Insert waypoint/destination (all INS).

(a) Select a waypoint (Example : 42°54.0' North, 87°54.9' West).

(b) To insert waypoint coordinates into all INS simultaneously press REMOTE key on each CDU and observe that REMOTE key illuminates on each CDU.

(c) Place data selector in WAY PT position or check that it is in this position and place waypoint/DMC selector in one remaining position (2 through 9 consecutively).

NOTE : Remaining steps of this procedure should be performed on any one CDU to remotely load waypoint data simultaneously into all INS.

(d)
- Press N2 key
  - observe that INSERT key illuminates and that 00°00.0 followed by correct letter (N) appears in LH data display.
- Press numbered keys in sequence 42540 and observe that correct latitude appears in LH data display.
- Press INSERT key
  - INSERT key extinguishes and loaded latitude is displayed.

(e)
- Load longitude by pressing keyboard keys in sequence starting with W87549
  - INSERT key illuminates when first key is pressed and longitude appears in RH data display as keys are pressed.
- Press INSERT key
  - INSERT key extinguishes and loaded longitude is displayed.

(f) If necessary repeat steps (d) and (e) for any additioned waypoint insertion and place waypoint/DME selector in positions 2 through 9 consecutively.

(g) Verify INS acceptance of waypoint data on CDU receiving system. It is not necessary to verify the transmitting INS if the receiving systems verify correctly. If waypoint data does not

verify correctly, reload waypoint data in the reverse direction, i.e. rotate waypoint/DME selector one position higher than the waypoint to be corrected and then back to the desired waypoint position, e.g. if waypoint 9 is to be corrected rotate to 0 and then back to 9.

(h) Press REMOTE key on each CDU and observe that each REMOTE key extinguishes.

(15) Manual insertion of DME station data

(a) To insert DME station data in all INS simultaneously, press REMOTE key on each CDU and observe that REMOTE key illuminates on each CDU.

(b) Place waypoint/DME selector to number of DME station to be loaded.

(c) Simultaneously press keyboard keys 7 and 9
- FROM portion of FROM-TO display goes blank. Number of DME station being used for navigation flashes on and off in TO portion. Data displays indicate last coordinates inserted.

NOTE : If number of new station to be loaded is the same as number of the DME station currently being used, number of the TO display will be set to 0 when DME data is loaded and DME updating on that station is terminated. Number in the TO display will also be 0 if no DME station has been selected for navigation or if designated station has not met range rate check for > 2.5 min.

(d) Load latitude by pressing keyboard keys in sequence, starting with N or S
- INSERT key illuminates when first key is pressed and latitude appears in LH data display as keys are pressed.

(e) Press INSERT key
- INSERT key extinguishes and loaded latitude is displayed.

(f) Load longitude by pressing keyboard keys in sequence, starting with E or W
- INSERT key illuminates when first key is pressed and longitude appears in RH data display as keys are pressed.

(g) Press INSERT key
- INSERT key extinguishes and loaded longitude is displayed.

(h) Simultaneously press keyboard keys 3 and 9
- data displays indicate last previously inserted altitude and frequency.

(i) Press keyboard key 2 or 8 to indicate following load is altitude
- INSERT key illuminates.

(j) Round off DME station altitude to nearest 1000 ft. and load the number in thousands by pressing keyboard keys in sequence (Example : 6600 ft. = 7000 ft. = 7 ; 12,300 ft. = 12,000 ft. = 12)
- number appears in LH display as keys are pressed.

NOTE : Only numbers 0 through 15 are accepted by the INS.

(k) Press INSERT key
- INSERT key extinguishes and loaded altitude is displayed.

(l) Press keyboard key 4 or 6 to indicate that following load is frequency
= INSERT key illuminates.

(m) Load frequency by pressing five keyboard keys in sequence (Example : 117.50 MHz = 11750)
- frequency appears in RH data display as keys are pressed. Display is in longitude format, for example 117.50 MHz appears as 11°75.0.

NOTE : Only frequencies from 108.00 to 135.95 MHz are accepted by the INS.

(n) Press INSERT key
- INSERT key extinguishes and loaded frequency is displayed.

(o) Repeat steps (b) through (n) for each DME station.

(p) Verify acceptance of all DME station data. If DME station data does not verify correctly, reload DME station data in reverse direction, i.e. rotate waypoint/DME selector one position higher than number of DME station data to be corrected and then back to desired position, e.g. if station 9

is to be corrected, rotate to position 0 and back to 9.

(q) To return INS to normal operation, momentarily place data selector in any position other than WAY PT and DIS/TIME.

(16) DME and waypoint data insertion using automatic data entry unit (ADEU)

(a) To insert data in all INS simultaneously, press REMOTE key on each INS, and ensure that all INS are using same navigation leg.

(b) Insert nav aid card into card insertion slot of ADEU. Coded side of card must be facing up with heavy black line on left
- READ indicator light on ADEU illuminates as card is taken into ADEU and extinguishes when reading is complete.

(c) Remove card from ADEU.

NOTE : If necessary, ADEU can be restarted by pressing the AUX START push-button.

NOTE : ERROR warning light on ADEU will illuminate if ADEU detects a card read error. Before starting another card read operation, ERROR warning light must be pushed and extinguished.

(d) Monitor CDU WARN warning light which will illuminate if data from ADEU fails reasonableness test. Place data selector in DSRTK/STS position if WARN warning light is illuminated and verify that ac-
B tion code 02 with malfunction code 55 are present. Malfunction code 55 should be cleared and card reinserted.

NOTE : Malfunction code may not appear for up to 12 seconds after nav aid card is inserted.

(e) Verify INS acceptance of flight plan data.

B (17) DME operational test (INS 1 & 2 systems only).

B (1) Switch on associated aircraft DME at VHF-NAV
B Controller (ref. 34-51-00).

B (2) Select frequency on controller compatible with

B test set.

B (3) Switch test set ON and set up test set such that
B distance indicated on DME is 50 NM.

B (4) With associated MSU selected to STBY carry out
B the following sequence of selections at the CDU.

B (a) Press "WPT CHNG".

B (b) Load '99'.

B (c) Press "INSERT".

B (d) Select "WAYPT".

B (e) Thumbwheel to '0'.

B (f) Load address 'N-374' on keyboard.

B (g) Press 'INSERT'.

B (h) Select 'DIS/TIME'.

B (5) Check that CDU readout is between 00007674 and
B 00010126.

B (6) Press WYPT CHG key to light.

B (7) Key in '1'.

B (8) Press CLEAR key and CDU will return to normal.

B (9) Switch off associated INS by setting MSU selector
B to OFF.

B D. Close-Up

B (1) Place mode selectors on MSU1, MSU2 and MSU3 in
B OFF position
B - on Captain instrument panel, INS1, INS2 and INS3
B warning lights on ISCU warning indicator illuminate.
B - INS warning light on master warning panel illu-
B minates.
B - press INS warning light to extinguish.
B - all changeover switches back to normal.

B (2) Trip the following circuit breakers :

B

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
B FLT CONT & NAV BUSS 14XS	2-213	X 355	H 2
B NAV INST BUS 13XS	13-216	X 345	G 3

B B (3) Switch off electronics rack ventilation system (Ref. 21-21-00).

B B B (4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

3. System Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Plug GZAP 2525 (only on 7881710-007 programmed units)	
Access Platform, Height of Access 3.46 m (11 ft. 4 in.)	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00, Servicing).

CAUTION : IF DURING TEST, ON PANEL 2-214, FLOW WARNING LIGHTS ILLUMINATE BECAUSE OF A VENTILATION SYSTEM FAILURE, SWITCH OFF INS. SYSTEMS IMMEDIATELY.

(3) On panel 8-214, make certain that mode selectors on mode selector unit (MSU) are in OFF position.

(4) On compass coupler controller, place DG/MAG switches in MAG position (Ref. 34-21-00, Adjustment/Test).

(5) On panel 9-211, place ADC1 and ADC2 switches in ON position (Ref. 34-11-00, Adjustment/Test).

(6) Position access platform at INS compartment.

(7) Open INS compartment access door 123BB.

(8) Remove INS compartment forward panel.

(9) Set the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYST 1 SW SUP		1F 134	F14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
ADC 1 28V SUP		1F 74	P12
MWS SUP 1		W 252	N21
AUDIO WARN SYS SUP 1		W 371	M21
AP/FD SYS 1 SUP	2-213	1C 20	C 5
ADC 1 26V SUP		1F 78	A 2
INS COMPTR SUP 2		F 3	A 6
ADI PLTS INS 3 SUP & IND		3F 30	A 7
HSI TRUE 1ST PLT INS 1 SUP & IND		1F 21	B 6
ADI 1ST PLT INS 1 SUP & IND		1F 15	B 7
HSI MAG 1ST PLT INS 1 SUP & IND		1F 16	B 8
ADI PLT INS 3 SUP & IND		3F 15	D 7
INS 1 SUP		1F 14	E 6
INS 1 HTR SUP		1F 20	F 6
INS COMPTR SUP 1		F 4	F 7
COMPASS COUPLER 1 SUP		1F 130	F 8
FLT CONT & NAV BUS		X 355	H 2
ADC2 28V SUP	5-213	2F 74	F12
FWD FLOW & RH FWD AIR SUP & EXTRT FAN IND		H1187	C 8
REAR FLOW & LH FWD AIR SUP & REAR FAN IND		H1186	C 9
AUDIO WARN SYS SUP 2		W 372	C17
MWS SUP 2		W 251	D15
INS 3 HTR SUP	13-215	3F 20	A 7
COMPASS COUPLER 2 STBY SUP		2F 131	B 7
INS 3 SUP		3F 14	C 7
AP/FD SYS 2 SUP	13-216	2C 20	A17
INS COMPTR SUP 3		F 2	B15
ADI 2ND PLT INS 2 SUP & IND		2F 15	C13
HSI MAG 2ND PLT INS 2		2F 16	C14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SUP & IND			
HSI TRUE 2ND PLT INS 2 SUP & IND		2F 21	C15
INS 2 HTR SUP		2F 20	D14
COMPASS COUPLER 2 NORM SUP		2F 130	D15
INS2 SUP		2F 14	G15
NAV INST BUS		X 345	G 4
RH DIGITAL DISPLAY DIMMING SUP	15-216	L1216	A13
COMPASS COUPLER SYS 2 SW SUP		2F 134	A21
R B NAV/INS 2ND PLT SW SUP		2F 34	C21
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
LH DIGITAL DISPLAY DIMMING SUP	15-215	L1211	G14
GROUND CALL HORN	16-215	H1216	
BATT A CONTROL		1P 24	
BATT A INDICATION		D 124	

(10) System 1

(a) On panel 5-211, place RAD/INS selector switches in INS position.

(b) On Captain instrument panel place switches
- ATT INS1/ATT INS3 in ATT INS1 position.
- COMP1/COMP2 in COMP1 position.
- NAV INS1/NAV INS2 in NAV INS1 position.

(c) On First Officer instrument panel place switches
- ATT INS3/ATT INS2 in ATT INS2 position.
- COMP1/COMP2 in COMP2 position.
- NAV INS1/NAV INS2 in NAV INS1 position.

(d) On both HSI
- INS1, TRUE and HDG indications are visible.
- HDG and NAV flags are visible.
- R B G/S flag is out of view
- R B G/S pointer is out of view
- R B TO/FROM arrows are out of view.

(e) On Captain ADI
- G flag is visible.

(f) On Captain instrument panel, INS1, INS2 and INS3 warning lights on ISCU warning indicator are illuminated.

R B On both RMI/VOR and RMI/ADF compass flags are
R B visible.

C. System Test

(1) INS ventilation warning (Battery operation warning system). Electronics rack ventilation system is in operation. The three MSU mode selectors are in OFF position.
Aircraft battery A is installed.
On panel 6-214, place BATT A switch in ON position.

(a) INS1 ventilation warning

(a1) Place MSU1 mode selector in STBY position.

(a2) On Flight Engineer panel place GROUND POWER - TRIP/CLOSE switch in TRIP position

= on CDU1, BAT warning light illuminates
- warning horn in nose landing gear bay sounds (after a brief delay).

(a3) Place MSU1 mode selector in OFF position

- warning horn stops.

(a4) On Flight Engineer panel place GROUND POWER - TRIP/CLOSE switch in CLOSE position
- on Captain instrument panel, INS1 warning light on ISCU warning indicator illuminates.

(b) INS2 and INS3 ventilation warning

(b1) Repeat steps (a1) through (a4). Replace MSU1 and CDU1 by MS2 and CDU2 or MSU3 and CDU3.

(2) System startup (all INS)

R B (a) Repeat functional test 2. C. (7) through (17) inclusive.

(3) TRUE AIRSPEED : INS1 - INS3

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(a) Place ADC1 test selector switch in 1 position
- when blue caption light illuminates press FAIL caption light to reset ADC.

(b) On CDU1, place mode selector in WIND position
- RH data display indicates a speed of 398 ± 4 kt.

(c) On CDU3, place mode selector in WIND position
- RH data display indicates a speed of 398 ± 4 kt.

(d) INS2

(d1) Repeat steps (a) and (b). Replace ADC1 and CDU1 by ADC2 and CDU2.

(4) TRUE HEADING comparison

(a) Place data selector on CDU1 and CDU3 in HDG/DA position.

(b) Check on both HSI that true headings are identical within 1°.

(c) Check in LH data displays on CDU1 and CDU3 that TRUE HEADING are identical to the nearest tenth of a degree.

(5) Magnetic HEADING

(a) On panel 5-211, place Captain and First Officer RAD/INS switches in RAD position
- on both HSI, RAD and MAG markers appear.
- G/S and NAV flags appear.
- G/S pointer appears.
- check that HEADINGS are identical within 1° (compass coupler 1 heading - compass coupler 2 heading).

(b) Place Captain and First Officer ATT INS switches in ATT INS3 position
- again check on both HSI that HEADINGs are identical within 1°.

NOTE : Switching of ATT INS switches causes HDG flags to appear on both HSI for some seconds.

(c) On panel 5-211, place Captain and First Officer RAD/INS switches in INS position.

(6) ATTITUDE information

(a) Place Captain and First Officer ATT INS switches in ATT INS1 and ATT INS2 position respectively.

(b) Check on both ADI that attitude is identical to within 0.5° (INS1 - INS2 attitude).

(c) Place Captain ATT INS switch in ATT INS3 position
- check on both ADI that attitude is identical to within 0.5° (INS3 - INS2 attitude).

(d) Place Captain ATT INS switch in ATT INS1 position.

(e) Place First Officer ATT INS switch in ATT INS3 position
- check on both ADI that attitude is identical to within 0.5° (INS1 - INS3 attitude).
Place First Officer ATT INS switch in ATT INS2 position.

(7) ATT mode

(a) On MSU1, place mode selector in ATT position
- CDU1 extinguishes.
- Captain ADI continues to indicate aircraft attitude (INS1).

On Captain HSI
- HDG and NAV flags appear.
- drift pointer disappears.
- MILES and GND SPD counters extinguish.
- HDG marker appears.

On Captain instrument panel, INS1 warning light on ISCU warning indicator illuminates.

(a1) Shut down INS1 : place MSU1 mode selector in OFF position.

(a2) INS warning light on master warning panel illuminates.
Press INS warning light to extinguish.

(b) On MSU2, place mode selector in ATT position
- CDU2 extinguishes.
- First Officer ADI continues to indicate aircraft attitude (INS2).

On First Officer HSI
- HDG and NAV flags appear.
- drift pointer disappears.
- MILES and GND SPD counters extinguish.
- HDG marker appears.

On Captain instrument panel, INS2 warning light on ISCU warning indicator illuminates.

(b1) Shut down INS2 : place MSU2 mode selector in OFF position.

(b2) INS warning light on master warning panel illuminates.
Press INS warning light to extinguish.

(c) Place Captain and First Officer ATT INS switches in ATT INS3 position.

(d) On MSU3, place mode selector in ATT position
- CDU3 extinguishes.
- Captain and First Officer ADI continue to indicate aircraft attitude (INS3).
- on Captain instrument panel, INS3 warning light on ISCU warning indicator illuminates.

(d1) Shut down INS3 : place INS3 mode selector in OFF position.

(d2) INS warning light on master warning panel illuminates.
Press INS warning light to extinguish.

(e) Place Captain and First Officer ATT INS switches in ATT INS1 and ATT INS2 positions respectively.

(8) Gimbal slew test (only on 7881710-007 programmed units)

(a) System 1 test

(a1) Ensure MSU1 mode selector is in OFF position.

(a2) In INS compartment
- remove four screws, washers and access cover plate with gasket from socket at front of INU.

(a3) Retain all items for re-installation.

(a4) Insert slew plug GZAP 2525 in socket at front of INU (only on 7881710-007 programmed units).

(a5) Rack ventilation run.
Place MSU mode selector in ALIGN position.
Slewing will begin at alignment number 8 at the rate of about 1° per minute, giving nose-up and right bank simultaneously. Slewing is stopped by selecting OFF on the MSU.

NOTE : A bank angle of 60° should not be exceeded during slew test.

(a6) MSU mode selector is in OFF position.

(a7) Remove slew plug from socket at front of INU.

(a8) Replace access cover plate with gasket and the four washers and screws retained in step (a3).

(a9) Select ALIGN on MSU1.

(a10)On CDU1, place AUTO-MAN/TEST switch in AUTO position.

(a11)Place CDU1 data selector in POS position.

(a12)Press and hold AUTO-MAN/TEST switch
- verify that data and FROM-TO displays show all 8's and all lamps are illuminated.

(a13)Place data selector in DSRTK/STS position.

(a14)Press and release AUTO-MAN/TEST switch
- check that no malfunction codes are displayed.

(a15)INS shutdown
- place MSU mode selector in OFF position.

(b) System 2 and system 3 test

(b1) Repeat steps (a1) through (a15). Replace MSU1 and CDU1 by MSU and CDU2 or MSU3 and CDU3.

D. Close-Up

(1) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 3

(2) Switch off electronics rack ventilation system (Ref. 21-21-00, Servicing).

(3) Shut down compass coupler (Ref. 34-21-00, Adjustment/ Test).

(4) Shut down ADCs (Ref. 34-11-00, Adjustment/Test).

(5) Install INS compartment forward panel.

(6) Install INS compartment access door 123BB.

(7) Remove access plarform.

(8) De-energize aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

MODE SELECTOR UNITS - SERVICING

1. General

   A. The INS mode selector units (MSU) are located in the Engineer's 8-214. Individual lamps and the illuminated panel may be replaced while the INS is operating, without affecting the system alignment or operation.

2. Relamp MSU Annunciators
   (Ref. Fig. 301)

   A. Equipment and Material

      (1) Lamp - 28 volts, 40ma, type MS18209-387 (preferred) or MS25237-327.

   B. Replace Lamp

      (1) Unscrew annunciator lens cap and remove

      (2) Pull lamp from lens cap.

      (3) Insert new lamp in lens cap.

      (4) Reinstall lens cap (green lens cap in READY NAV and red lens cap in BAT annunciator).

      (5) Perform step 3 (Test MSU Lamp).

3. Test MSU Lamps

   A. Provide instrument panel lighting power (Ch. 33)

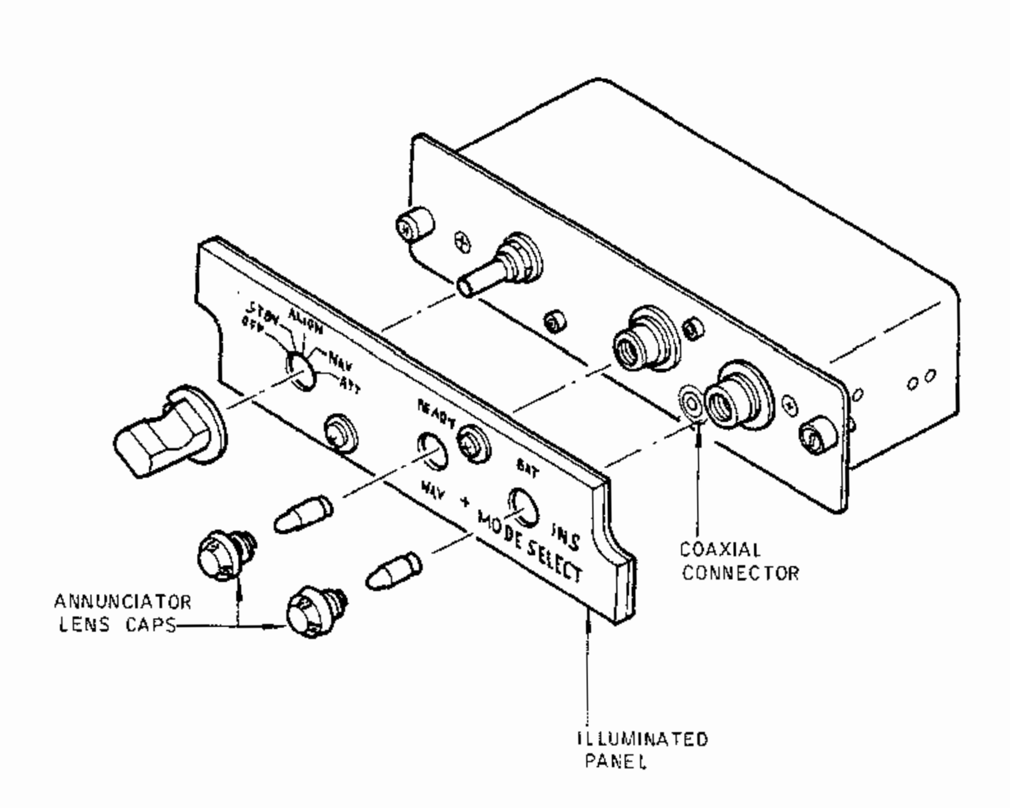
   B. Check that illuminated panel lights on the MSU when panel lighting power is applied to pilots overhead panel.

   C. Vary intensity of pilots overhead panel lighting and observe that illuminated panel varies accordingly.

   D. On MSU, check that mode selector switch is in any "ON" position.

   E. Set the appropriate CDU data selector switch to the DSRTK/STS position.

   F. Momentarily press the CDU TEST switch and observe that both annunciator lamps illuminate.



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Mode Selector Unit : Relamping disassembly.
Figure 301

G. If INS is no longer required, set mode selector switch to OFF and restore airplane to normal.

MODE SELECTOR UNITS 1F12, 2F12, 3F12 REMOVAL/INSTALLATION

1. General

The INS mode selector units 1F12, 2F12 and 3F12 are located at Flight Engineer Station in zone 8-214.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Access Platform, Height of Access 3.46 m (11 ft. 4 in.)	

B. Prepare

(1) Position access platform at equipment bay.

(2) Open equipment bay access door 123BB.

(3) Removal panel 123BZ from shelf.

(4) Trip circuit breaker on front panel of battery units 1F10, 2F10, 3F10 associated with the MSU being removed.

(5) Place mode selector Switch on appropriate MSU in OFF position.

(6) Trip the following circuit breaker :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
CONSOLE PNL LTG SUP	13216	L377	E 7

C. Remove

(1) Gain access to Flight Engineer station to remove appropriate MSU.

(2) Refer to 34-00-00, Removal/Installation, paragraph 3.D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.F.

F. Test

(1) Set circuit breaker on front panel of battery unit associated with MSU being removed.

(2) Carry out a display test of INS system associated with replaced MSU (Ref. 34-45-00, Adjustment/Test, Operational Test).

G. Close-Up

(1) Install panel 123BZ on shelf.

(2) Close equipment bay access door 123BB.

(3) Remove access platform.

CONTROL DISPLAY UNITS - SERVICING

1. General

A. The INS Control/Display units (CDU) are located on the forward aft centre console panels 7-211. Individual lamps, data displays and the illuminated panel may be replaced while the INS is operating, without affecting the system alignment or operation.

B. The only exception is the illuminated waypoint thumbwheel. This lamp cannot be changed on the flight line.

2. Relamp CDU Keys and Annunciators

A. Equipment and Material

(1) Lamp, 28 volts, 40 ma - Type MS 18209-387 (preferred) or MS 25237-327.

(2) Lamp, 14 volts, 80 ma - AC Electronics, P/N 7890382-001

(3) Lamp, 6 volts, 200 ma - Type MS 25237-328

RB (4) Lamp, DT1673A (DATA DISPLAY)

RB (5) Modified Tweezers P/N DT 1973A (For CDU P/N 7891390)

RB B. Prepare (Ref. Figs. 301)

RB (1) Unfasten the three clips on the indicator access
RB panel and remove the bar.

RB (2) Remove the access panel.

RB C. Replace CDU lamps (Ref. Figs. 301, 302, 303)

RB (1) For data display units P/N 7883460.

RB (a) Pull the required digital display indicator.

RB (b) Unfasten the retaining clip or remove a
RB screw.

RB (c) Pull the required lamp module and replace
RB the lamp.

RB (d) Install the lamp module.

RB (e) Fasten the retaining clip or install the
RB screw.

(f) Install the digital display indicator.

(2) For data display units P/N 7891390

(a) Loosen the centre captivated screw or loosen the two captive screws and remove the display cap.

(b) Remove the lamp(s) with the modified tweezers (DT 1973A).

(c) Install a new lamp with the modified tweezers (DT 1973A).

(d) Install the display cap and tighten the centre captivated screw or the captive screws.

D. Replace Annunciator Lamps (Ref. Fig. 301, 304)

(1) Pull the annunciator lamp cover or key from its socket.

(2) Pull the lamp from the lamp cover or key.

(3) Install a new lamp in the lamp cover or key (Refer to Figure 304 for the correct lamp size).

<u>CAUTION</u>: WHEN RELAMPING, TAKE CARE TO INSTALL THE CORRECT TYPE OF LAMP. ONLY 28-VOLT LAMPS ARE USED IN BATT AND WARN ANNUNCIATORS. FAILURE TO USE CORRECT BULB CAN CAUSE TRANSISTOR BURNOUT IN NAVIGATION UNIT.

(4) Install the lamp cover or Key.

E. Close-up

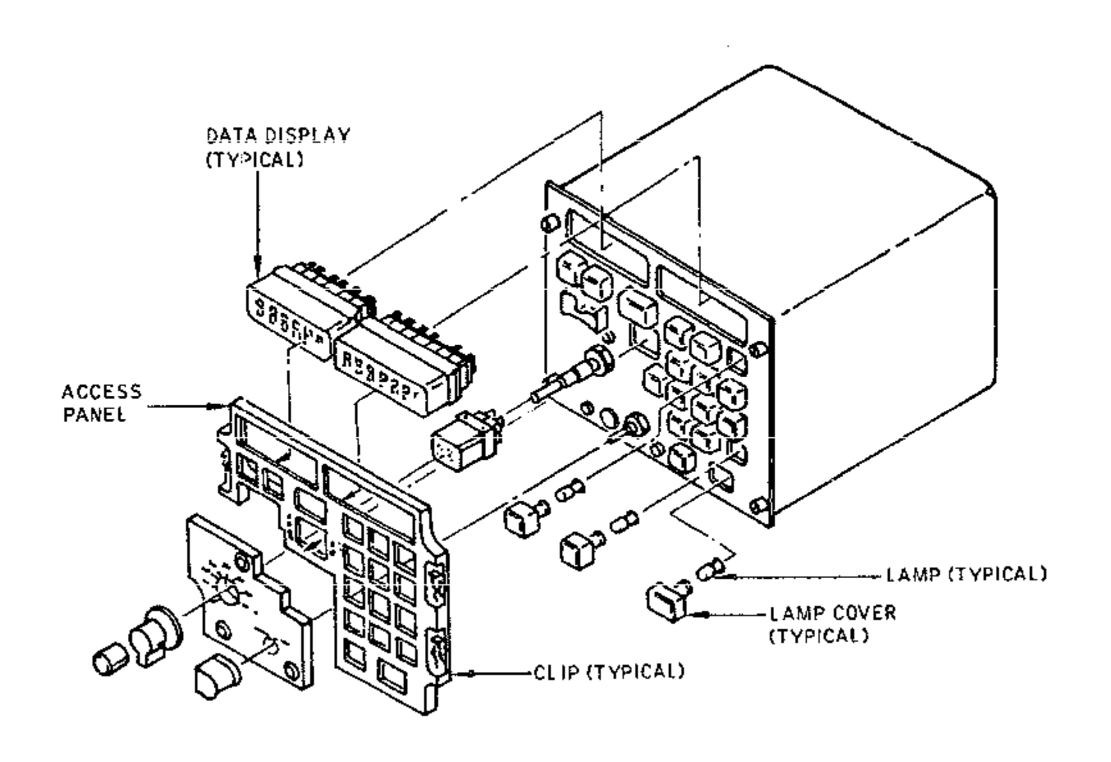
(1) Install the access panel and fasten the three clips.

(2) Perform step 3. (Test CDU Lamps).

3. Test CDU Lamps

A. Provide instrument panel lighting power (Ref. Ch.33).

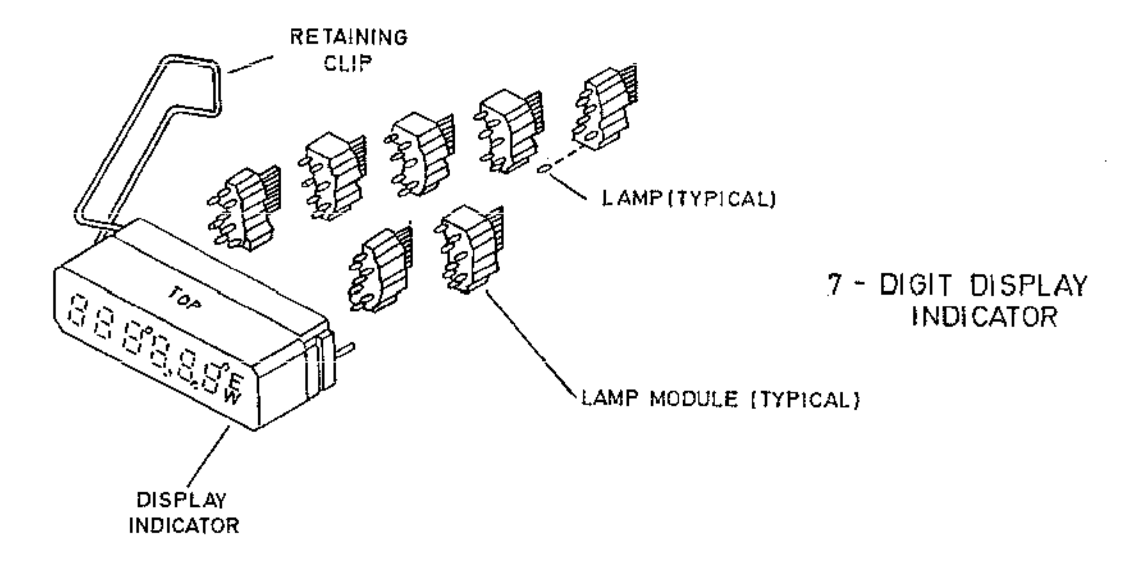
B. On CDU, check that illuminated panel and all data keys (including CLEAR) light when panel lighting power is applied to forward and aft control stand electronic panels.

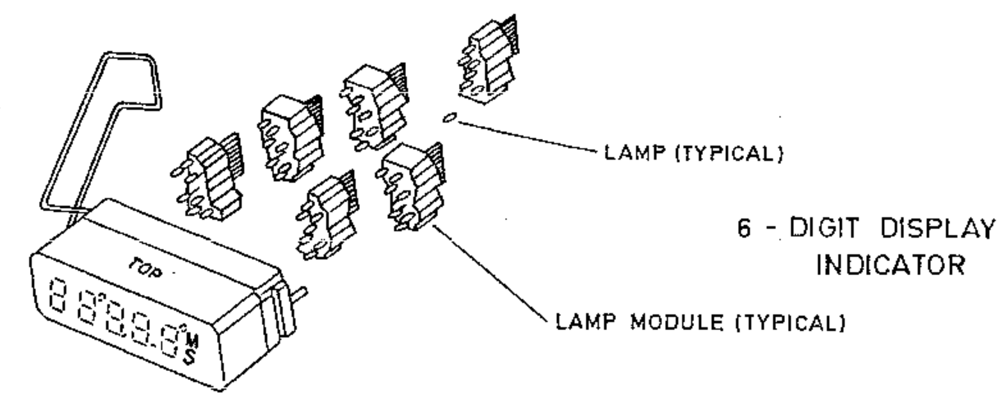


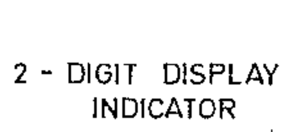
CMA 34 45 13 3 AAM0

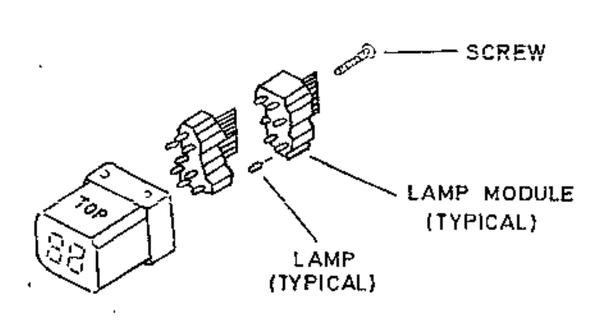
Control Display Unit : Relamping disassembly
Figure 301

Control Display Unit : Relamping disassembly
Figure 301



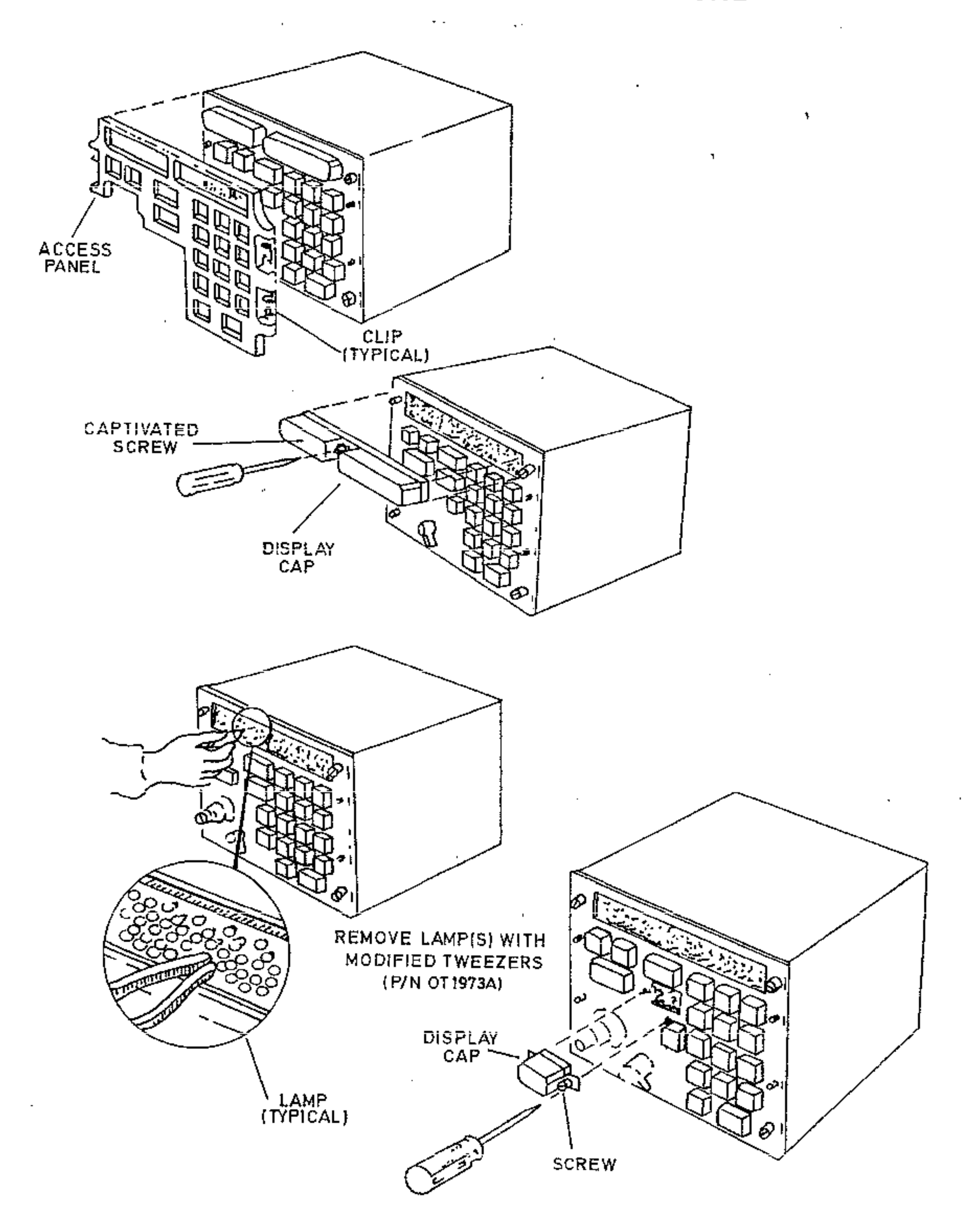




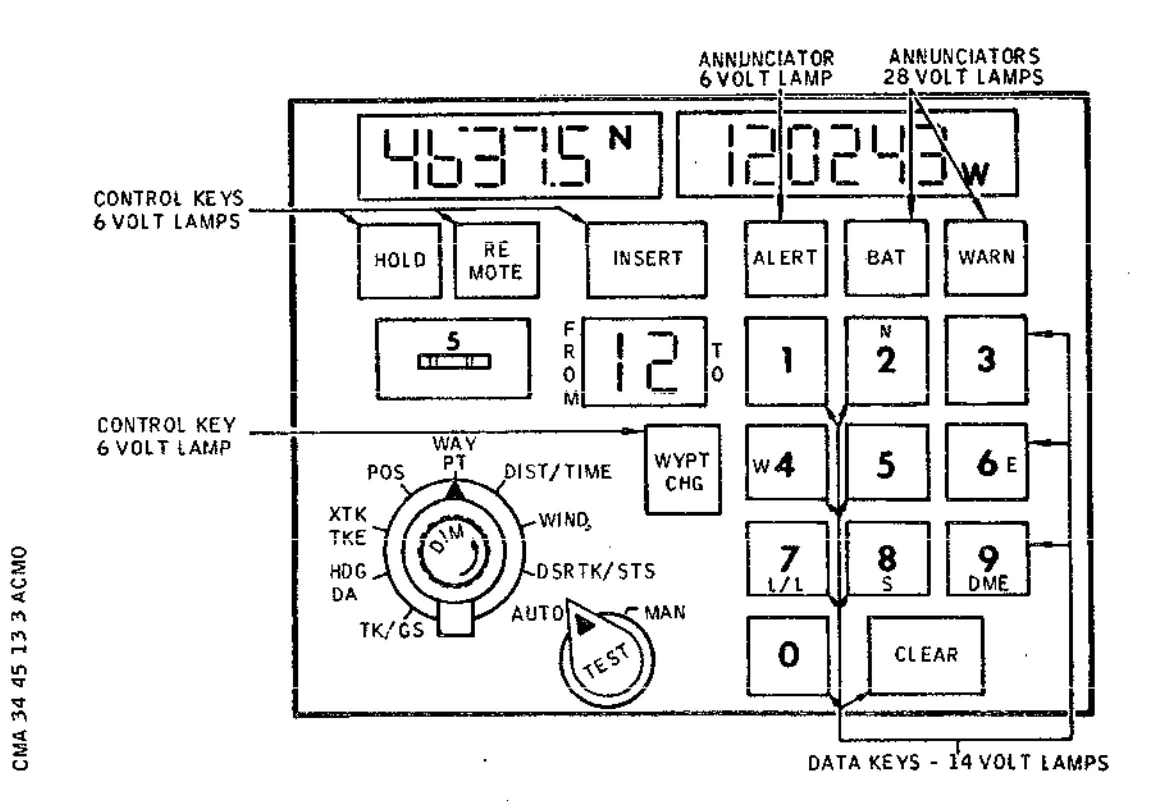


CMB 34-45-13 3 ABM0 00

Digital Display Indicators
Figure 302



Digital Display Indicators
Figure 303



Control Display Unit : Lamp Replacement
Figure 30*

Control Display Unit : Lamp Replacement
Figure 304

C. Vary intensity of control stand panel lighting and observe that illuminated panel and all data keys on CDU vary accordingly.

D. Check that mode selector switch (8-214) is in any "on" position.

E. Set CDU data selector switch to the POS position.

WARNING: IF TEST SWITCH IS PRESSED WHILE P1 IS GREATER THAN 6 (RIGHT DISPLAY, FIFTH DIGIT), DATA SELECTOR IS NOT IN DSTRK/STS AND MODE IS NOT NAV, THE AUTOPILOT IS AUTOMATICALLY SENT A COMMAND FOR RIGHT BANK. IF AUTOPILOT AND HYDRAULIC SYSTEMS ARE OPERATING, FLIGHT SURFACE MOVEMENT COULD OCCUR, ENDANGERING PERSONNEL.

F. Momentarily press CDU TEST switch. While switch is depressed, observe that :

(1) All control key and annunciator lamps illuminate.

(2) Left-hand data display is indicating 88°88.8N/S.

(3) Right-hand data display is indicating 888°88.8E/W.

(4) FROM-TO display is indicating 8 8.

(5) Intensity of all lamps in steps (1) through (4) varies when the CDU DIM knob is turned.

NOTE: This does not apply to the BAT and WARN annunciator lamps.

(6) Set CDU data selector switch to HDG/DA position and observe:

- degree symbol in both displays moves to right of last 8.
- decimal in right-hand display disappears.

(7) Set CDU data selector switch to XTK/TKE position and observe in left-hand display that decimal symbol moves one digit left and degree symbol disappears.

G. If INS is no longer needed, set each mode selector switch to OFF and restore airplane to normal.

CONTROL DISPLAY UNITS 1F11, 2F11, 3F11 - REMOVAL/INSTALLATION

1. General

The INS CDUs 1F11, and 2F11 are located on the LH and RH side of forward centre console 7-211, and CDU 3F11 on aft centre console 9-211.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	

B. Prepare

(1) Place mode selector switch on appropriate MSU in OFF position.

(2) Trip the following circuit breaker :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
CONSOLE INST LTS SUP	14-216	L405	B 8

C. Remove

(1) Gain access to flight compartment for removal of appropriate CDU.

(2) Refer to 34-00-00, Removal/Installation, paragraph 3-D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 3-E.

E. Install

(1) Refer to 34-00-00, paragraph 3-F.

F. Test

(1) Carry out a display test of INS system associated with replaced CDU (Ref. 34-45-00, Adjustment/Test, Operational Test)

G. Close-Up

Not applicable.

ATT - INS SWITCH - REMOVAL/INSTALLATION

1. General

Captain ATT INS1 - ATT INS3 switch 1F7 is located on Captain instrument panel, panel 2/2-211
First Officer ATT INS2 - ATT INS3 switch 2F7 is located on First Officer instrument panel, panel 4/2-212

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
DEV1 & DEV2 1ST PLT SW SUP		1R 38	G14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
COMPASS COUPLER SYS2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV1 & DEV2 2ND PLT SW SUP		2R 38	F21

C. Remove ATT - INS switch

(1) Refer to 33-16-00, Removal/Installation, for electroluminescent (EL) panel

(2) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

D. Preparation of Replacement Component

Not applicable

E. Install

(1) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

(2) Refer to 33-16-00, Removal/Installation, for EL panel.

F. Tests

(1) Refer to 33-10-00, Adjustment/Test, close-up for typical toggle switch.

(2) Check switch operation by carrying out ATT INS switch test procedures (Ref. 34-45-35, Adjustment/Test).

(3) Refer to 33-16-00, Removal/Installation, paragraph 2.G.(1) through (5) for EL panel.

G. Close-Up

(1) Refer to 34-45-35, Adjustment/Test, paragraph D.

WARNING INDICATOR - REMOVAL/INSTALLATION

1. General

The warning indicator (F141) is installed on Captain instrument panel 2-211-6. Removal of the indicator is performed either for its own replacement or for replacement of the lamps.

2. Warning Indicator Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps/Plugs for Electrical Connectors	

B. Prepare

(1) On panel 12-211, make certain that D/B LIGHT switch is in HI position.

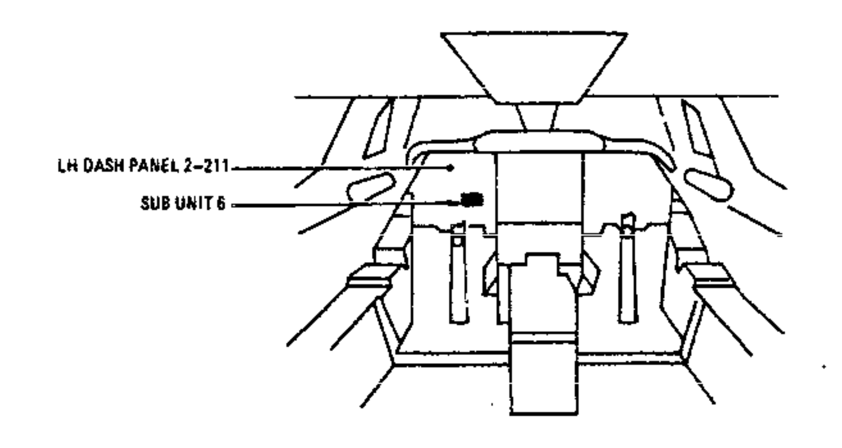
(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
INS COMPTR SUP & IND	1-213	F5	G15
INS COMPTR SUP2	2-213	F3	A 6
INS COMPTR SUP1		F4	F 7
PLT'S LT TEST SUP	15-215	L1001	E14
INS COMPTR SUP3	13-216	F2	B15

C. Remove (Ref. Fig. 401)

(1) Place dimming slider (2) in front of each caption screen indicator.

(2) Loosen and remove two screws (6) securing warning indicator (4) and mechanical dimmer assembly (7) to panel 2-211-6.



1 SEATING
PANEL 2-211-6
CONNECTOR 8
2 SLIDER DIMMING
3 RECEPTACLE
MECHANICAL DIMMER ASSY 7
INS 1
INS 2
INS 3
CON
5 CAPTION FRAME
4 WARNING INDICATOR
6 SCREW
CNIA 34 45 15 4 AAHD

Removal/Installation of Warning Indicator
Figure 401

(3) Remove warning indicator and dimmer assembly from its seating (1) on panel 2-211-6.

(4) Disconnect aircraft connector (8) from warning indicator receptacle (3).

(5) Cap connector (8) and receptacle (3).

(6) Separate warning indicator (4) from mechanical dimmer assembly (7).

NOTE : Make certain that dimming sliders do not come out of holder which is not fitted with a retaining stop.

D. Preparation of Replacement Component

(1) Make certain that the warning indicator is in good condition and that the receptacle bears no trace of corrosion.

(2) Remove caption frame (5) and replace the four caption screws as required.

E. Install (Ref. Fig. 401)

(1) Remove blanking caps from connectors (3) and (8).

(2) Install warning indicator (4) in seating of mechanical dimmer assembly (7).

(3) Connect receptacle (3) on warning indicator to aircraft connector (8).

(4) Install mechanical dimmer assembly and warning indicator in its seating (1) on panel 2-211-6.

(5) Install dimming sliders (2) in front of each caption screen indicator.

(6) Insert and tighten two securing screws (6).

F. Close-Up

(1) Remove safety clips and tags and reset circuit breakers tripped in paragraph 2.B.(2).

(2) Test warning indicators (Ref. 34-45-15, Adjustment/Test).

3. Replacement of a Warning Indicator Lamp

Replacement of one of all the lamps can only be performed after warning indicator removal/installation (Ref. paragraph 2.).

A. Equipment and Materials

DESCRIPTION	PART NO.
Lamp Filament 28 V, 0.02 A	

B. Prepare

(1) Refer to paragraph 2.B.

C. Remove Warning Indicator

(1) Refer to paragraph 2.C.

D. Replacement of Lamp

(1) With a straight pull, release lampholder assembly from base/block assembly detent position.

(2) Pivot lampholder assembly through 90° upwards.

(3) Remove lamp(s) to be replaced from their seating.

(4) Install new lamp(s) in their seating.

(5) Pivot lampholder assembly through 90° downwards.

(6) With a straight push, lock lampholder assembly in base/block assembly detent position.

E. Install Warning Indicator

(1) Refer to paragraph 2.E.

F. Close-Up

(1) Refer to Close-Up in paragraph 2.F.

WARNING INDICATOR - ADJUSTMENT/TEST

1. General

This test is carried out after replacement of the warning indicator or lamp replacement.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) On panel 12-211, make certain that D/B LIGHT switch is placed in HI position.

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation (Ref. 21-21-00).

(4) On panel 2-211-6, slide the dimming slider, so that INS1, INS2, INS3 and COM captions are in view.

C. Test

(1) On Captain side console 12-211, place and hold D/B LIGHT switch in TEST position.
- On panel 2-211-6 the red INS1, INS2, INS3 and amber COM warning lights are illuminated.

(2) Release D/B LIGHT switch, making certain that it returns to HI position, and that :
Red INS1, INS2, INS3 and amber COM warning lights are extinguished.

D. Close-Up

(1) On panel 2-211-6, return dumming slider to central position.

(2) Switch off electronics rack ventilation system

(Ref. 21-21-00).

(3) Disconnect electrical ground power unit and de-energize the aircraft electrical network (Ref. 24-41-00, Servicing).

AUTOMATIC DATA ENTRY UNIT (ADEU) REMOVAL/INSTALLATION

R B NOTE: After MOD 34C297 No. 1 and No. 2 ADEU is removed and
R B all references should be ignored.

1. General

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps for Electrical connectors	

B. Prepare

(1) On overhead panel 4-211, make certain that CENTRE CONSOLE PANEL selector switch is placed in OFF position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
CARD READER 1 SUP	15-215	1F 222	D 5
CARD READER 2 SUP	15-216	2F 222	E20

C. Remove

(1) Carry out the operations described in 34-00-00, Removal/Installation, paragraph 3.D.

D. Preparation of Replacement Component

(1) Carry out the operations described in 34-00-00, Removal/Installation, paragraph 3E.

E. Install

(1) Carry out the operations described in 34-00-00, Removal/Installation, paragraph 3.F.

F. Close-Up

(1) Remove safety clips and tags and reset circuit breakers

previously tripped in 2.B.(2)

(2) Carry out a check of the ADEU, Ref. 34-45-00, Adjustment/Test (Functional Test, "DME and Waypoint Data Insertion using ADEU" paragraph).

NAV - INS SWITCH - REMOVAL/INSTALLATION

1. General

Captain NAV INS1 - NAV INS2 switch 1F33 is located on Captain instrument panel, panel 2/2 - 211.
First Officer NAV INS2-NAV INS3 switch 2F33 is located on First Officer instrument panel, panel 4/2-212.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1STPLT SW SUP	1-212	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
DEV1 & DEV2 1STPLT SW SUP		1R 38	G14
ATT/INS 1STPLT SW SUP		1F 13	G16
READ/INS 1STPLT SW SUP		1F 26	G17
COMPASS COUPLER SYS 2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
READ/INS 2ND PLT SW SUP		2F 26	E21
DEV 1 & DEV 2 2ND PLT SW SUP		2R 38	F21

C. Remove NAV - INS switch

(1) Refer to 33-16-00, Removal/Installation, for electro-luminescent (EL) panel.

(2) Refer to 33-10-00, Removal/Installation, for typical

toggle switch.

D. Preparation of Replacement Component

Not applicable.

E. Install

(1) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

(2) Refer to 33-16-00, Removal/Installation, for EL panel.

F. Tests

(1) Refer to 33-10-00, Adjustment/Test, Close-Up for typical toggle switch.

(2) Check switch operation by carrying out NAV - INS switch test procedures (Ref. 34-45-35, Adjustment/Test).

(3) Refer to 33-16-00, Removal/Installation, paragraph 2.G (1) through (5) for EL panel.

G. Close-Up

(1) Refer to 34-45-35, Adjustment/Test, Paragraph D.

R/NAV ANNUNCIATORS REMOVAL/INSTALLATION

1. General

The R/NAV annunciator illuminates each time an inertial navigation system receives Analog Distance Pulse data from the corresponding DME.

Two annunciators are installed on the aircraft, each one in an annunciator assembly located on panels 2-211-4 (1F 227) and 2-212-3 (2F 227)

2. Removal/Installation

A. Refer to 34-41-22, Removal/Installation paras. 2. and 3.

R B. Carry out a test of annunciator assembly, Ref. 34-41-22, Adjustment/Test.

INERTIAL NAVIGATION UNITS 1F8, 2F8 AND 3F8 - REMOVAL-INSTALLATION

1. General

The inertial navigation units 1F8, 2F8 and 3F8 are rack mounted equipment installed on shelf 27-123 in aircraft equipment bay FR8/FR18.
Access to equipment bay is gained through access door 123-BB.
No. 2 INU is installed on LH side, No. 3 INU in the center, and No. 1 INU on RH side of equipment bay, facing aft.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Access Platform, Height of Access 3.46 m (11 ft.4in.)	

B. Prepare

(1) Position access platform at equipment bay.

(2) Open equipment bay access door 123BB.

(3) Remove panel 123CZ from shelf.

(4) Remove panel 123BZ from shelf.

(5) Trip circuit breaker on front panel of battery unit 1F10, 2F10, 3F10 associated with INU being removed.

(6) On ADC control panel, on center console 9-211, make certain that ADC1 and ADC2 ON-OFF switches are in OFF position.

(7) Set mode selector switch on appropriate MSU to OFF position.
On Captain and First Officer instrument panel place ATT INS switches respectively in ATT INS 1 and ATT INS 2 position.

(8) Trip safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
INS 3 26V SUP	2-213	3F 30	A 7
HSI TRUE 1STPLT INS 1 SUP & IND		1F 21	B 6
ADI 1STPLT INS 1 SUP & IND		1F 15	B 7
HSI MAG 1STPLT INS 1 SUP & IND		1F 16	B 8
AP/FD SYS 1 SUP		1C 20	C 5
ADI PLT INS 3 SUP & IND		3F 15	D 7
INS 1 HTR SUP		1F 14	E 6
DME1 SUP		1S 4	E 7
INS 1 SUP		1F 20	F 6

C. Remove INU

(1) Gain access to shelf 27-123 to remove appropriate INU.

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.D. (2).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.F. (2).

F. Install

(1) Reset circuit breaker on front panel of battery unit associated with INU being removed.

(2) Carry out display test for replacement INU on CDU. Refer to 34-45-00, Adjustment/Test, Operational Test.

G. Close-Up

(1) Replace equipment bay access panels 123CZ and 123BZ.

(2) Close equipment bay access door 123BB.

(3) Remove access platform.

ATT INS & NAV SWITCHING UNITS 1F9 & 2F9 - REMOVAL/INSTALLATION

1. General

ATT INS & NAV INS switching units 1F9 & 2F9 are rack mounted equipment installed on shelf 26-123 in aircraft equipment bays F8/F18.
Access to equipment bays is gained through access door 123BB.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit-Breaker Safety Clips	
Blanking Caps	
Access Platform, Height of Access 3.46 m (11 ft. 4 in.)	

B. Prepare

(1) Position access platform under equipment bays.

(2) Open equipment bay access door 123BB.

(3) Remove relevant access panel.

(4) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1STPLT SW SUP	1-213	1F 34	E15
ATT/INS 1STPLT SW SUP		1F 13	G16
HSI TRUE 1STPLT INS1 SUP & IND	2-213	1F 21	B 6
ADI 1STPLT INS2 SUP & IND		1F 15	B 7
ADI 2NDPLT INS2 SUP & IND	13-126	2F 15	C13
HSITRUE 2NDPLT INS2 SUP & IND		2F 21	C15

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 2NDPLT SW SUP	15-216	2F 34	C 2
ATT/INS 2NDPLT SW SUP		2F 13	D 21

C. Remove Switching Unit 1F9

(1) Gain access to shaft 26-123, RH side.

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.D.(1).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.F.(1).

F. Remove switching unit 2F9

(1) Gain access to shelf 26-123, LH side.

(2) Repeat steps 2.C., D., and E. above.

G. Test

(1) Carry out a test of switching unit installed (Ref. 34-45-36, Adjustment/Test).

H. Close-Up

(1) Install relevant access panel.

(2) Close equipment bay access door 123BB.

(3) Remove access platform.

ATT INS & NAV INS SWITCHING UNITS 1F9 & 2F9 - ADJUSTMENT/TEST

1. General

Test to be carried out following removal/installation of :

A. Switching unit 1F9 or 2F9,

B. An ATT INS switch,

C. A NAV INS switch.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical GroundPower Unit	

B. Prepare

(1) Start up the three INS (Ref. 34-45-00, Adjustment/Test, Operational Test).

C. Test of Switching Unit 1F9, 2F9

(1) Test of ATT INS switches and ATT INS switching units 1F9 and 2F9.

(a) Place Captain and First Officer RAD INS switches in INS position.

(b) Place Captain ATT INS switch in ATT INS 1 position.

(c) Place First Officer ATT INS switch in ATT INS2 position.

(c1) At appropriate STATUS or ALIGMENT No., on both ADI
- G flag disappears, attitude drum erects.

(d) Place Captain and First Officer ATT INS switches in ATT INS3 position.

(d1) On both ADI
- G flag remains out of view, attitude drum

remains erect.

(e) Shut down INS3

(e1) On both ADI
- G flag appears, attitude drum returns to zero position.

(2) Test of NAV INS switches and NAV INS switching units 1F9 and 2F9

(a) Place Captain and First Officer NAV INS switches in NAV INS1 position.

(b) Carry out an INS1 test

(b1) On both HSI
- INS1 system test configuration is visible ; 1, INS and TRUE are visible.

(c) Place Captain and First Officer NAV INS switches in NAV INS2 position.

(d) Carry out an INS2 test

(d1) On both HSI
- INS2 system test configuration is visible ; 2, INS and TRUE are visible.

D. Close-Up

(1) Shut down the two INS (Ref. 34-45-00, Adjustment/Test, Operational Test, paragraph D.).

BATTERY UNITS 1F10, 2F10 AND 3F10 REMOVAL/INSTALLATION

1. General

The INS Battery Units 1F10, 2F10 and 3F10 are rack mounted equipment installed on shelf 26-123 in aircraft equipment bay F8/F18. Access to equipment bay is gained through access door 123BB. Battery unit No.1 is installed facing aft near the aircraft centre line. Battery units No.2 and NO.3 are installed on LH side.

R B NOTE : AFTER MOD CM 42611, INS No.1 Battery unit (1F10) and
R B INS No.2 Battery Unit (2F10) are removed and INS No.1
R B and INS No.2 are connected to aircraft Battery A and B
R B respectively.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Blanking Caps	
Access Platform, Height of Access 3.46 in. (11 ft. 4 in.)	

B. Prepare

(1) Place mode selector switch on appropriate MSU in OFF position.

(2) Position access platform at equipment bay.

(3) Open equipment bay access door 123BB.

(4) Remove panel 123BZ from shelf.

(5) Trip circuit breaker on front panel of battery unit being removed.

C. Remove

(1) Gain access to shelf 26-123 to remove appropriate battery unit.

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.D. (2).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Make certain that circuit breaker on front panel of replacement battery unit is tripped before installing unit in battery rack.

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.F. (2).

F. Test

(1) Set circuit breaker on front panel of installed battery unit.

(2) Carry out start-up procedure of system associated with replaced battery (Ref. 34-45-00, Adjustment/Test, Operational Test).

G. Close-Up

(1) Install panel 123BZ on shelf.

(2) Close equipment bay access door 123BB.

(3) Remove access platform.

END OF THIS SECTION

NEXT

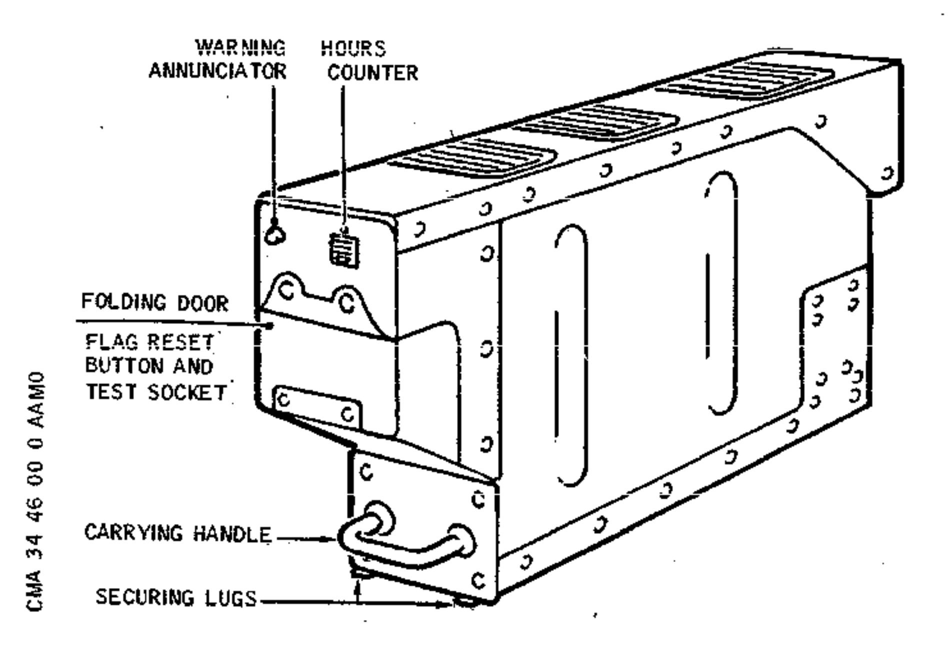
R INERTIAL SIGNALS COMPARATOR UNIT (ISCU) - DESCRIPTION AND OPERATION

1. General

The inertial signal comparator is a safety monitoring device whose function is to monitor output information from the three
R Inertial Navigation Systems (INS), the two Attitude Director
R Indicators (ADI), the two Horizontal Situation Indicators (HSI),
R COURSE SET selection from the AFCS controller and the two Compass Couplers.
This monitoring increases the degree of flight safety and
R enables aircraft automatic landing in category III A visibility.

R 2. Inertial Signals Comparator Unit (ISCU)

A. Description (Ref. Fig. 001)



ISCU - General View
R Figure 001

R The inertial signals comparator unit is housed in a 3/8 ATR short case of length 425 mm, width 90.5 mm, height 195 mm,
R weight less than 5.6 Kg (12.3 lb). The front panel is fitted

with two fixing lugs, a carrying handle, a warning light, a warning reset button, an hour counter and a test socket. The rear panel is fitted with an external interconnection socket. The top and bottom panels are perforated to provide unit ventilation. The unit interior is divided into four zones

- power supply-connector-self-detected failure signal input circuits
- compartment containing 6 large boards
- compartment containing 6 small boards
- front zone consists of front panel instruments.

B. Operation (Ref. Fig. 002)

The comparator system is based on digital comparison of received information and logical detection of fault signals. It functions mainly in two modes :

- Cruise mode
- Approach mode.

Cruise mode is activated for the whole flight and provides :

- Pitch and roll attitude monitoring of the three INS. Monitor threshold 4°54'
- Monitoring of instrument pitch and roll attitude information from Captain and F/O ADI. Monitor threshold 3°51'
- Monitoring of instrument heading information from Captain and F/O HSI. Monitor threshold 3°51'

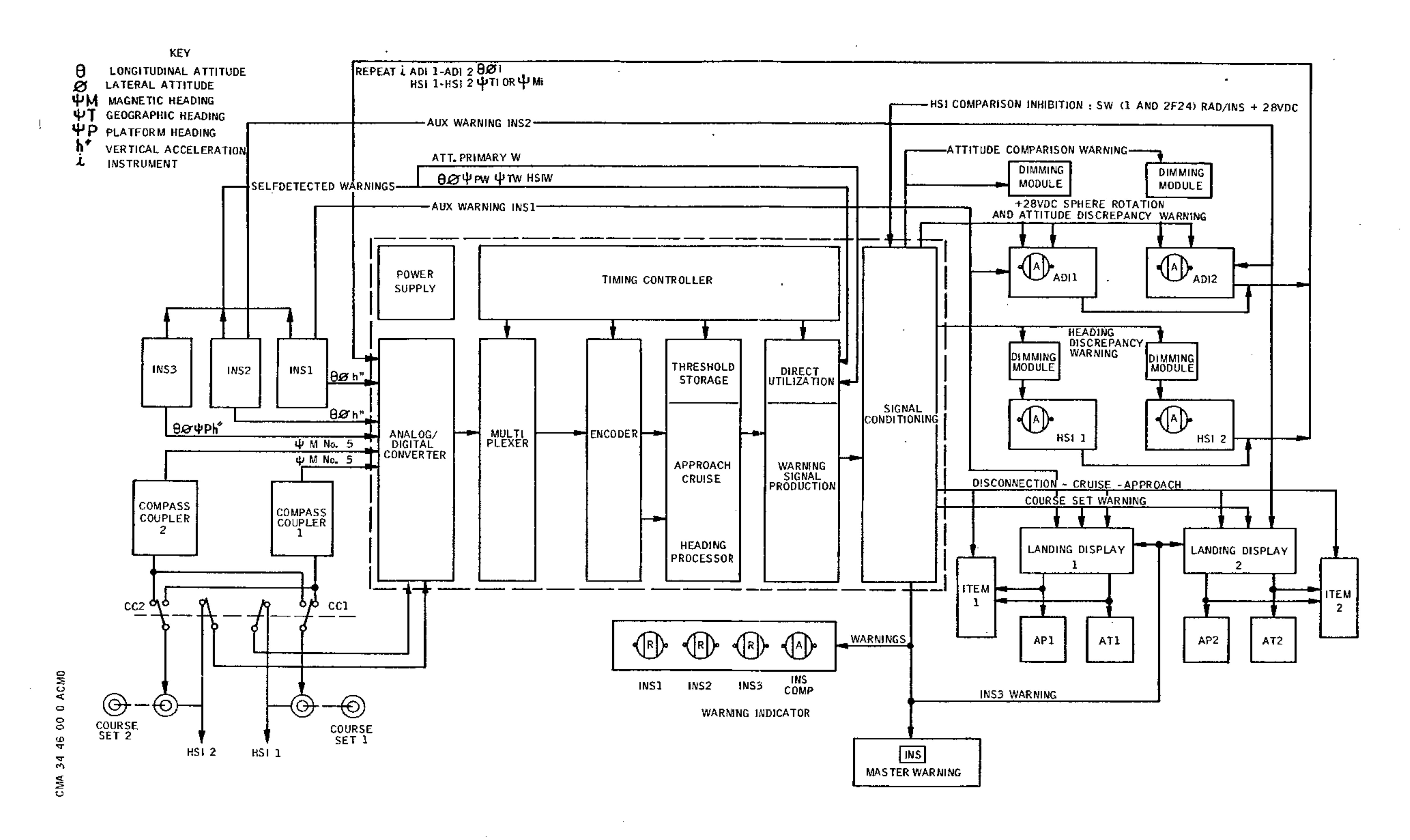
R

Approach mode is activated below 600 ft if LAND SELECT condition is in operation or if glide capture is engaged, and provides :

- Monitoring of pitch and roll attitude information from the 3 INS with a threshold of 2°27'
- Monitoring of INS3 platform heading variations with respect to compass coupler 1 and 2 magnetic heading variations. Monitor threshold 3°51'
- Monitoring of vertical acceleration from the three INS. Monitor threshold 0.047g.
- Monitoring of Course Set Data from AFCS controller. Monitor threshold 3°51'.

Eleven parameters are processed by the ISCU :

1-Test channel (computer automatic test)
2-Roll attitude instrument information



R

ISCU - Operational Block Diagram
Figure 002

R 3-INS roll attitude (approach)
4-INS heading
5-Instrument heading
R 6-Instrument pitch attitude
7-Vertical acceleration
R 8-INS pitch attitude
9-Course set (AFCS controller)
R 10-INS roll attitude (cruise)
R 11-INS pitch attitude (cruise)

R Comparison of received information, of less than 18 ms duration, is sequenced by a synchronizer which ensures encoding, comparison and generation of fault signals for each parameter.

R Time spacing between 2 successive encodings is less than 500 microseconds.

A fault signal only appears if a fault is detected for 15 consecutive sequences of the same parameter, that is, a total time of 18 ms x 15 = 270 ms.

R The ISCU is in four main functional sections :

- Analog digital converter
- Comparator section
- Fault logic
- Test circuits.

(1) Analog/digital converter
- R Converts analog input information into digital data for use by the ISCU. It performs the following functions :

  - R Disconnects ISCU from data sources
  - R Adapts input data for input to encoder (Signal level and type)
  - Reduces dynamic and quadrature errors by demodulation and filtering.

Multiplexer stage :
- R Under control of synchronizer, switches to the encoder :
  two angle information inputs (sin-cos), a voltage and a reference voltage for acceleration information.

R Encoder :

- R Converts analog information into digital data in the form of 14 bit words for an-

R gles, and 12 bit words + 1 sign bit for
voltages.

(2) Comparison channel

The three INS are compared two by two. The channel calculates differences between similar type information

R - Compares differences at thresholds stored in memory
- Develops out of limit signal when appropriate.

R NOTE : In approach mode, calculation of differences
is not made directly for platform and compass
R coupler headings, but by monitoring signal
variations with reference to initial values
stored at beginning of approach. (These are
R mean values of four consecutive codings).

(3) Fault logic circuitry

This circuitry enables faults to be identified from out of limit signals information (INS fault, instrument or remote selection divergence).

(a) In approach mode

First fault

R Self-detected INS faults
R ISCU indicator light corresponding to faulty unit
illuminates, without fault being memorised by
R ISCU. No disconnection of AP or AT occurs and
comparison continues.

R Fault detected by ISCU

This illuminates indicator light and fault is
R memorised, disconnections are authorised, and
R comparison continues between other systems.

R For a self-detected INS fault which is simulta-
R neously detected by the ISCU, action is as fol-
lows :

R Self-detected fault on two INS, and detected by
R ISCU.

R The ISCU causes illumination, without memori-
sation, of indicator light appropriate to INS
R with self-detected fault, illuminates with memori-
sation indicator light appropriate to INS detec-

ted by comparators, authorises AP and AT disconnection for the system on which fault is detected by ISCU. Comparison continues on the two other systems.

Second fault :

After memorisation of a first fault, if an out of limits condition is again determined, failure is considered permanent.
If in addition the fault is self-detected, the ISCU illuminates indicator light corresponding to this system, and disconnection commands existing after first fault are unchanged.

Double fault :

This is encountered when the three comparison signals derived from a single information signal simultaneously exceed the comparison limit. This fault is considered permanent. If two of the INS transmit self-detected fault signals, the ISCU illuminates the two corresponding warning lights. In all other cases, ISCU illuminates the 3 warning lights. In none of these cases is AP or AT disconnection caused.

(b) In cruise mode

Monitoring of pitch and roll attitude parameters produces warning signals which are combined with INS self-detected signals and ISCU comparison signals to obtain for each INS a unique INS failure signal. It also enables generation of cruise disconnection signals independent of AP or AT approach disconnection commands. System operates as follows : when two of the three comparisons relative to the attitude parameters simultaneously exceed cruise limit, the INS common to these two comparisons is indicated as faulty. If variation falls below limit, INS is no longer indicated as faulty. An INS is also indicated as faulty when it sends a self-detected failure signal. ISCU action will vary depending on whether failure is due to a self-detected attitude fault (PRIMARY ATT WARNING) or a secondary self-detected (HSI, true or platform heading warning) fault.

First failure detected by ISCU.

R ISCU illuminates warning light corresponding
to INS without memorisation, gives cruise discon-
nection order to systems associated with faulty
R INS, without memorisation : (AP if altitude is
R above 600 ft, AT if altitude is below 600 ft).
R ISCU continues comparison of the three systems.
R If the INS also has a self-detected fault condi-
R tion, if it is a PRIMARY ATT WARNING, the ISCU
R holds the indication but inhibits the cruise dis-
R connection order. If it is a secondary self-
R detected fault, indication and disconnection order
R are maintained. This is because the PRIMARY ATT
R WARNING causes direct disconnection.

Second failure detected by ISCU.

R If the two INS are not in self-detected fault
condition, ISCU illuminates the three warning
lights without memorisation, gives disconnection
orders to the two systems without memorisation.
If the two systems are in auto-detected fault
R condition, and both are secondary self-detected
faults, ISCU illuminates warning lights of the
two faulty units, gives cruise disconnection
order to associated systems ; if condition is two
R PRIMARY ATT WARNING self-detected faults, ISCU
illuminates only warning lights corresponding
R to the two faulty INS, without memorisation. This
R is because the PRIMARY ATT WARNING causes direct
R disconnection.

R Self-detected failures without detection by
comparators.

R ISCU illuminates warning light corresponding to
faulty INS without memorisation, continues compa-
rison on the three INS (for secondary self-
R detected faults).
R For a self-detected PRIMARY ATT WARNING fault,
ISCU illuminates INS warning light without memo-
risation, does not authorise cruise disconnection,
R continues comparison on the three INS.
R For two self-detected PRIMARY ATT WARNING faults,
ISCU illuminates INS warning lights without memo-
risation, does not authorise cruise disconnection
and inhibits cruise attitude comparisons.
R For three self-detected PRIMARY ATT WARNING
faults, ISCU illuminates three INS warning lights
without memorisation, continues comparison on the
three systems, authorises disconnection commands
for one or two of the INS also detected as faulty

by the ISCU.

(c) For instrument and COURSE SET information, discrepancy is indicated by ISCU when comparison threshold is exceeded.

(d) Rotation control of ADI attitude drum

(d1) Captain ADI attitude drum rotation

Three required conditions

- INS1 failure self-detected PRIMARY ATT WARNING or detected by ISCU (cruise or approach)
- Failure detected by ISCU on attitude information from ADI indicators
- No INS3 failure detected by ISCU in cruise comparison or self-detected PRIMARY ATT WARNING.

(d2) F/O ADI attitude drum.

Three required conditions

- Identical with those of Captain ADI but affecting INS2

(e) The self-detected fault signals from each INS are applied to the failure logic circuitry. (Self-detected faults remain active whether or not ISCU is supplied by the aircraft electrical network).

(4) Test circuits

Enable continuous monitoring of ISCU : consist of integrated test - continuous tests - on aircraft checks.

(a) Integrated test

For each sequence of data processing, a predetermined angle value is coded. Comparison of this value with stored value enables check of analog/digital converter operation.
Mutual comparison of these two values with a third value also stored in memory enables a check of complete channel up to failure logic stage, excluding multiplexer and input and output interfaces.

R An ISCU fault, confirmed by four successive
R cycles, is indicated by illumination of INS COMP
R warning light on Captain instrument panel and on
R ISCU by warning magnetic indicator which turns to white.

(b) Continuous tests

These internal tests enable check of correct system operation :

- Check by monitor of presence of regulated power voltages
- Check of clock and synchronizer
- Check of INS 400 Hz demodulation reference signal
- Check of INS double fault detection circuitry (Test consists of a check for identical operation of the dual circuits)
- R R Check of heading parameter calculation circuitry.
- R Check of program run.

(c) Test connector

R A set of signals are fed to the test connector in order to facilitate maintenance operations.

(5) Power supply

R R R The unit is supplied with 115VAC, 26VAC reference voltage (two sources) and + 28VDC warning supply. Each AP supplies ± 15VDC required for disconnection orders and COURSE SET warning.
Power switch-on initializes unit (duration approximately 90 ms). During initialization disconnection orders are inhibited and warnings suppressed.
R R Front panel warning indication is cancelled either by tripping and resetting of 115V 400 Hz circuit breaker, or by pressing front panel reset push-button. If warning indication is not cancelled, it will not affect correct system operation. If after initialization INS
R R R COMP warning light on Captain instrument panel remains illuminated, either an inertial signals comparator failure or loss of 115V or 26V 400Hz is possible.

R (6) ISCU monitoring coverage

(a) INS

(a1) INS analog signals

INS 1 and 2 supply :
R Pitch attitude (0 ± 90°)
R Roll attitude (0 ± 180°)
by synchro-transmitters.
INS 1, 2 and 3 supply : vertical acceleration information in form of variable DC voltage levels applied to differential amplifiers.
Platform heading is supplied by synchro-transmitter by INS 3 only.

(a2) INS logic signals

R Each system supplies four internal monitor (+ 28VDC) and warning (0 volt) signals.

R - PRI ATT warning
- Platform HDG warning
R - True HDG warning
- HSI warning.

(a3) Indications of INS failure

R - One of three red indicator lights on 4-window-indicator illuminates, on Captain instrument panel (INS 1, INS 2 or INS 3)
- Indicator light INS on master warning panel illuminates, single stroke gong sounds
R R - ADI or HSI indicators associated with faulty system activate appropriate warning lights
R R - According to the type of fault, ISCU warnings sent to Warning and Landing Display (W & LD) System authorise AP and AT disconnection depending on flight configuration, and on altitude (above or below 600 ft.) conditions.

R (a4) Selection of INS in ATT mode

R R R According to the nature of an INS fault, the Captain or F/O can place the faulty INS in ATT mode. If failure is in INS 1 or INS2, warnings cause disconnection of associated AP and AT. After switching HSI and ADI to available INS and cancellation of warnings, ISCU continues to display warnings for the two INS in correct operation.
R R On Captain instrument panel, INS warning light corresponding to the INS in ATT mode remains illuminated.
R INS warning light on master warning panel

which has been cancelled will only illuminate again for a fault self-detected by the INS in ATT mode. ISCU cannot alone activate this indicator light. For the other two INS, warning detection by the ISCU remains normal.

(b) Compass coupler

The two compass couplers supply magnetic heading in analog signal form.
- A magnetic heading fault will be seen as an INS fault detected by ISCU in approach mode only (no heading monitoring in cruise mode).

(c) Horizontal situation indicator (HSI)

Captain and F/O HSI supply the ISCU with a repeat of the headings to which they are slaved, in analog signal form. Comparison is only made of similar type heading references (the 2 RAD/INS switches must be in the same position. If they are not, a + 28VDC comparison inhibit signal is sent to the ISCU).

(c1) Indicator of out of limits warning

The ISCU produces a warning signal (+ 28 VDC) in case of a difference greater than 3°51". This signal causes illumination of HDG warning lights on HSI. If this difference falls below limit threshold, warning is cancelled.

(d) Attitude director indicator (ADI)

The ADIs repeat pitch and roll attitude indications and send them to the ISCU, in analog signal form.

(d1) Warning signals :
- these are of two types :

(d2) A signal produced by the ISCU (+ 28VDC) for a discrepancy greater than 3.51°. This signal causes illumination of CHECK ATT indicator lights on ADIs. If this difference falls below limit threshold, warning is cancelled.

(d3) If the three following conditions are simultaneously present :

R - Pitch and roll attitude differences greater
R than 3°51'.
- INS fault corresponding to ADI receiving signal from it.
R - No INS 3 fault :
R ISCU produces a (28 VDC) ADI attitude drum rotation signal giving 90° rotation nose-
R down, and appearance of G flag on appropriate ADI.

R NOTE : When an ADI is switched to INS3, atti-
R tude drum rotation command cannot be applied. An INS 3 failure inhibits sphere rotation.

R (e) AFCS control unit (COURSE SET).

R The ISCU compares headings displayed on Captain
R and F/O control units ; these are in analog form. Comparison is active in approach mode only.

(e1) Warning indication

R When the ISCU detects a difference greater
R than 3°51' between two displayed headings, it produces a warning signal (+ 15 V) for Warning and Landing Display System and lateral AP decrab function. When a selected heading is not referenced to its original magne-
R tic heading, the ISCU does not receive the difference signal (switching must be CC1/AP1
R and CC2/AP2), otherwise ISCU comparison would cause loss of LAND 3 capability and of decrab function of lateral AP.

R (f) Warning and landing display (W & LD) system

R W & LD system executes cruise and approach disconnection orders from the ISCU and INS. It
R authorizes activation of ISCU approach function
R for altitudes below 600 ft.
Presence of ISCU fault signal, course set warning
R or INS3 failure causes loss of LAND 3 capability.

(g) ITEM

R The integrated test and maintenance system moni-
R tors the following signals :

ISCU approach disconnection order
ISCU cruise disconnection order

R W & LD system AP and AT disconnection order.
INS failure : AUX FAIL WARNING INS 1 and 2

R This monitoring enables origin of the disconnection to be identified.

(h) ISCU failures

When the ISCU indicates a fault condition, amber
R INS COMP warning light on Captain instrument panel illuminates, disconnection orders and comparison warnings are inhibited. In automatic approach, at altitudes below 600 ft (Glide Capture or Land select) LAND 3 capability is lost.

INERTIAL SIGNALS COMPARATOR UNIT (ISCU) - TROUBLE SHOOTING

WARNING : OBSERVE THE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The most probable basic faults are treated in their order of importance and are identified by test results. They can occur in flight or on the ground.
The defects can be isolated with the aid of the trouble shooting procedures (Ref. Paragraph 3.) and traced through OK and NOT OK paths to the appro-priate charts or other specified rectification action as may be necessary.
If a defect occurs, perform the appropriate rectification action then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information including component location required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Prepare

A. Perform job set up described in paragraph 2. (Functional Test, (Ref.34-46-00, Adjustment/Test).

B. On panel 5-211, place RAD/INS switches in INS position.

C. On Captain instrument panel 2-211, place switches :
(1) ATT INS1/ATT INS3 in ATT INS1 position.

(2) NAV INS1/NAV INS2 in NAV INS1 position.

(3) COMP1/COMP2 in COMP1 position.

D. On F/O instrument panel 2-212 place switches :

(1) ATT INS2/ATT INS3 in ATT INS2 position.

(2) NAV INS1/NAV INS2 in NAV INS2 position.

(3) COMP1/COMP2 in COMP2 position.

NOTE : On panel 2-211, INS1, INS2 and INS3 warning lights are illuminated.
On ISCU, warning light is illuminated.
These warning lights extinguish when NAV is selected on associated MSU

3. Trouble Shooting

```
*****************************************************
* On Captain side console 12-211, place and hold HI-*
* LO-TEST switch in TEST position. On instrument    *
* panel 2-211, the following warning lights illumi- *
* nate :                                            *
* - INS1, INS2, INS3, COM, on warning indicator [1] *
* - HDG, on HSI [2]                                 *
* = Check ATT on ADI [3]                            *
* Release switch, the warning lights extinguish.  IF*
*****************************************************
    |          |     ----------------------------------------------
    |          |     |One of the warning lights on warning indica- |
    |    NOT OK--|tor [1], on HSI [2] or ADI [3] does not illu-|
    |          |     |minate. Replace lamps of defective warning   |
    |          |     |light.                                       |
    |          |     ----------------------------------------------
    |          |
    |          |     ----------------------------------------------
    |          |     |The four warning lights on warning indicator |
   OK    NOT OK--|[1] do not illuminate. Ref. Chart 101.      |
    |          |     ----------------------------------------------
    |          |
    |          |     ----------------------------------------------
    |          |     |The warning lights on warning indicator [1], |
   OK    NOT OK--|on HSI [2] and ADI [3] do notilluminate.    |
    |          |     |(Ref. 33-14-00, Trouble Shooting).           |
    |          |     ----------------------------------------------
    |
*****************************************************
* On First Officer's side console 5-212 place and   *
* hold HI-LO-TEST switch in TEST position.          *
* On instrument panel 2-212 the following warning   *
* lights illuminate :                               *
* - HDG, on HSI [4]                                 *
* - CHECK ATT, on ADI [5]                           *
* Release switch, the warning lights extinguish.  IF*
*****************************************************
    |          |
    |          |     ----------------------------------------------
    |          |     |The warning light on HSI [4] or ADI [5] does |
    |    NOT OK--|not illuminate. Replace lamps of defective  |
    |          |     |warning light.                               |
    |          |     ----------------------------------------------
   OK          |
    |          |     ----------------------------------------------
    |          |     |The warning lights on HSI [4] and ADI [5] do |
    |    NOT OK--|not illuminate. (Ref. 33-14-00, Trouble     |
    |          |     |Shooting                                     |
    |          |     ----------------------------------------------
```

```
    |
*****************************************************
* On panel 4-211, press MWS display panel LTS-TEST  *
* pushbutton and make certain that all warning      *
* lights are illuminated (INS warning light in par- *
* ticular)                                          *
* Release the pushbutton. All the warning lights ex-*
* tinguish.                                       IF*
*****************************************************
    |          |
    |          |     ----------------------------------------------
    |          |     |INS warning light does not illuminate. Ref. |
    OK       NOT OK--|Chart 102.                                  |
    |          |     ----------------------------------------------
    |

*****************************************************
* Check that warning annunciator on ISCU front panel*
* is not activated. (Persistence of alarm does not  *
* adversely affect correct ISCU operation). To      *
* cancel alarm, trip circuit breaker F4 [7] and     *
* press reset button on ISCU front panel.         IF*
*****************************************************
    |     |
    |     |    ---------------------------------------------
    |     |    |Annunciator cannot be reset. Check 115 VAC from F4|
    OK  NOT OK--|[7]. (The extinguishing of COM warning light on   |
    |          |warning indicator indicates the presence of       |
    |          |115 VAC). If resetting is ineffective replace     |
    |          |ISCU. [8]                                         |
    |          ---------------------------------------------
    |
    |

*****************************************************
* On panel 2-213, trip circuit breaker F4 [7]       *
* - On Captain instrument panel 2-211 warning indi- *
*   cator [1] COM warning light illuminates. Set    *
*   circuit breaker F4, COM warning light on warning*
*   indicator extinguishes                        IF*
*****************************************************
    |     |
    |     |    ---------------------------------------------
    |          |COM warning light on warning indicator does not  |
    |   NOT OK--|illuminate. Replace ISCU [8].                     |
    |          ---------------------------------------------
    OK
```

```
    |
**************************************************
* On Captain panel 2-211 (F/O panel 2-212 ADI [3], *
* [5]) press and hold TEST pushbutton (Ref. 34-29-00*
* Adjustment/Test) :                               *
* - ADI [3] and [5] CHECK ATT warning lights illumi-*
* nate as soon as the instrument attitude comparison*
* threshold is reached                             *
* Release TEST pushbutton, the warning lights extin-*
* guish                                          IF*
**************************************************
    |     |
    |     |     ----------------------------------------------
    |     |     |CHECK ATT warning lights on ADI indicators do not |
   OK  NOT OK--|illuminate. Ref Chart 103                        |
    |     |     ----------------------------------------------
    |
**************************************************
* On Captain panel 2-211 (2-212) HSI [2] ([4]) press*
* and hold TEST pushbutton (Ref. 34-23-00,         *
* Adjustment/Test)                                 *
* HDG warning light on HSI's [2] and [4] illuminates*
* as soon as the instrument attitude comparison    *
* threshold is reached                             *
* Release TEST pushbutton, the warning lights extin-*
* guish                                            *
**************************************************
    |     |
    |     |     ----------------------------------------------
   OK  NOT OK--|HDG warning light on HSIs does not illuminate.   |
    |          |Ref. Chart 104                                   |
    |           ----------------------------------------------
    |
**************************************************
* SELF-DETECTED FAULTS BY INS1 (HSI WARNING)       *
* On panel 2-213, trip circuit breaker 1C20 [9], FD1*
* disconnects, FD flag appears on ADI, and after a *
* delay :                                          *
* - On Captain panel 2-211, INS1 warning light on  *
*   warning indicator [1] illuminates              *
* - On panel 4-211, INS warning light on MWS display*
*   panel [6] illuminates and gong sounds          *
* - On pedestal 7-211, on CDU [10] 03 Action Code  *
*   malfunction 24 appears                         *
* Reset circuit breaker 1C20 :                     *
* - INS1 and INS warning lights extinguish, gong   *
*   stops                                          *
* - FD flag on ADI disappears.                     *
*   Engage FD1                                     *
* - On CDU, Action Code 03 disappears            IF*
**************************************************
```

```
 |       |
 |       |      -------------------------------------------------------
 |       |      |INS1 warning lights on warning indicator and INS    |
 |       |      |warning light on MWS display panel do not illumi-   |
OK     NOT OK--|nate.                                                 |
 |       |      |Replace ISCU [8]                                     |
 |       |      -------------------------------------------------------
 |       |
 |       |      -------------------------------------------------------
OK     NOT OK--|Gong does not sound. Ref. 31-23-00, Trouble           |
 |       |      |Shooting                                             |
 |              -------------------------------------------------------
 |       |
 |       |      -------------------------------------------------------
OK     NOT OK--|03 Action Code does not appear with malfunction       |
 |       |      |24. Ref. 34-45-00, Trouble Shooting                  |
 |              -------------------------------------------------------
 |
*****************************************************
* SELF-DETECTED FAULTS BY INS1 (TRUE HEADING)       *
* On panel 2-213, trip circuit breaker 1F21 [11]    *
* On HSI [2], HDG flag appears and after a delay :  *
* - On Captain panel 2-211, INS1 warning light on   *
*   warning indicator [1] illuminates               *
* - On panel 4-211, INS warning light on master war-*
*   ning panel illuminates and gong sounds          *
* - On pedestal 7-211, on CDU [10], 03 Action       *
*   Code with malfunction 22, 23 and 25 appears     *
*   Reset circuit breaker 1F21 :                    *
* - INS1 and INS warning lights extinguish, gong    *
*   stops.                                          *
* - HDG flag disappears on HSI                      *
* - 03 Action Code disappears on CDU              IF*
*****************************************************
    |       |
    |       |      -------------------------------------------------------
    |       |      |INS1 warning lights on warning indicator and INS    |
   OK     NOT OK--|warning light on MWS display panel do not illumi-    |
    |       |      |nate. Replace ISCU [8].                             |
    |              -------------------------------------------------------
    |
    |       |      |-------------------------------------------------------
    |       |      |Gong does not sound. Ref. 31-23-00, Trouble          |
   OK     NOT OK--|Shooting                                              |
    |       |      |-------------------------------------------------------
    |
    |       |      |-------------------------------------------------------
   OK     NOT OK--|03 Action Code with malfunction 22, 23 and 25 does    |
    |       |      |not appear. Ref. 34-45-00, Trouble Shooting          |
    |       |      |-------------------------------------------------------
    |
```

```
    |
*****************************************************
* SELF-DETECTED FAULTS BY INS2 (HSI WARNING)         *
* On panel 13-216, trip circuit breaker 2C20 [12]    *
* FD2 disconnects, FD flag appears on ADI, and after*
* a delay :                                          *
* - On Captain panel 2-211, INS2 warning light on    *
*   warning indicator [1] illuminates                *
* - On panel 4-211, INS warning light on MWS display*
*   panel [6] illuminates and gong sounds            *
* - On pedestal 7-211, on CDU [13] 03, Action        *
*   Code with malfunction 24 appears                 *
*   Reset circuit breaker 2C20 :                     *
* - INS2 and INS warning lights extinguish, gong     *
*   stops.                                           *
* - FD flag on ADI disappears.                       *
*   Engage FD2.                                      *
* - On CDU, Action Code 03 disappears.             IF*
*****************************************************
    |     |
    |     |      ----------------------------------------------
    OK  NOT OK--|Analyses and remedial action identical to self-  |
    |     |     |detected faults by INS1 (HSI WARNING)            |
    |     |      ----------------------------------------------
    |
*****************************************************
* SELF-DETECTED FAULTS BY INS2 (TRUE HEADING)        *
* On panel 13-216 trip circuit breaker 2F21 [14]     *
* On HSI indicator [4] HDG flag appears and          *
* after a delay :                                    *
* - On Captain panel 2-211, INS2 warning light on    *
*   warning indicator [1] illuminates                *
* - On panel 4-211, INS warning light on MWS display*
*   panel [6] illuminates and gong sounds            *
* - On pedestal 7-211, on CDU [13] 03 Action         *
*   Code with malfunction 22, 23, 25 appears         *
* Reset circuit breaker 7F21 :                       *
* - INS2 and INS warning lights extinguish, gong     *
*   stops                                            *
* - HDG flag on HSI disappears                       *
* - On CDU, Action Code 03 disappears              IF*
*****************************************************
    |     |
    |     |      ----------------------------------------------
    OK  NOT OK--|Analyses and remedial action identical to self-  |
    |           |detected faults by INS1 (TRUE HEADING)           |
    |            ----------------------------------------------
```

```
    |
*****************************************************
* SELF-DETECTED FAULTS BY INS3 (HSI + TRUE HEADING) *
* On panel 2-213, trip circuit breaker 3F15 [15]    *
* - On Captain panel 2-211, INS3 warning light on   *
*   warning indicator [1] illuminates               *
* - On panel 4-211, INS warning light on MWS display*
*   panel [6] illuminates and gong sounds           *
* - On pedestal 9-211, on CDU [16] 03 Action Code   *
*   with malfunction 22, 23, 24 and 25 appears      *
* Reset circuit breaker 3F15 :                      *
* - INS3 and INS warning lights extinguish, gong    *
*   stops                                           *
* - On CDU, 03 Action Code disappears.            IF*
*****************************************************
    |     |
    |     |    ---------------------------------------------------
    OK  NOT OK--|Analyses and remedial action identical to self-   |
    |     |    |detected faults by INS1 (HSI and TRUE HEADING)    |
    |          ---------------------------------------------------
    |
*****************************************************
* SELF-DETECTED FAULTS (PRIMARY ATTITUDE WARNING)   *
* With the three INS operating :                    *
* On panel 2-213, trip circuit breaker 3F15 [15].   *
* The INS warning light on warning indicator  *
* [1] illuminates                                   *
* On panel 2-213, trip circuit breaker 1F15 [17]    *
* - INS1 and INS3 warning lights on warning indica- *
*   tor are illuminated                             *
* Trip circuit breaker 1F15 INS1 warning light      *
* extinguishes, INS3 warning light still remains    *
* illuminated                                     IF*
*****************************************************
    |     |
    |     |    ---------------------------------------------------
    |     |    |INS1 and INS3 warning lights are not illuminated  |
    OK  NOT OK--|on warning indicator                              |
    |     |    |Replace ISCU [8]                                  |
    |     |    ---------------------------------------------------
```

```
      |
*****************************************************
* On panel 13-216, trip circuit breaker 2F15 [18] : *
* - INS2 and INS3 warning lights on warning indica- *
*   tor are illuminated                             *
* Set circuit breaker 3F15 [15], INS3 warning light *
* extinguishes, and INS2 warning light remains illu-*
* minated                                         IF*
*****************************************************
      |     |
      |     |      ------------------------------------------
      OK   NOT OK--|INS2 and INS3 are not illuminated on warning indi-|
      |     |      |cator. Replace ISCU [7]                           |
      |     |      ------------------------------------------
      |
*****************************************************
* On panel 2-213, trip circuit breaker 3F15 [15] :  *
* - INS3 and INS2 warning lights on warning indica- *
*   tor are illuminated                             *
* Reset circuit breakers 3F15 and 2F15 :            *
* - INS2 and INS3 warning lights extinguish         *
* - INS warning light on MWS display panel extin-   *
*   guishes                                         *
* - Gong stops                                      *
* - 03 Action Code on CDU disappears                *
* Engage FD1 and FD2                              IF*
*****************************************************
      |     |
      |     |      ------------------------------------------
      |     |      |INS2 and INS3 warning lights are not illuminated |
      OK   NOT OK--|on warning indicator                             |
      |     |      |Replace ISCU [7]                                 |
      |     |      ------------------------------------------
      |
*****************************************************
* Make certain that radio altimeters are in opera-  *
* tion                                              *
* - On VOR-ILS-DME control units select an ILS fre- *
*   quency (108.3)                                  *
* - Select LAND mode                                *
* - On Captain's panel 2-211 (F/O 2-212) place RAD- *
*   INS switches in RAD position                    *
*****************************************************
      |     |
```

```
****************************************************
* COMPASS COUPLER 1 HEADING MONITORING (COMPASS    *
* COUPLER2) IN APPROACH MODE                       *
* On Flight Engineer panel 7-214, place DG/MAG No.1 *
* (No.2) switch on compass coupler control unit in  *
* DG position.                                      *
* By means of DEC/INC switch, vary compass coupler  *
* No.1 heading (No.2 heading) by 6° to 8°, then     *
* release switch and check that :                   *
* FD1 (FD2) switch disengages                       *
* INS1 (INS2) warning lights on warning indicator   *
* and INS warning lights on MWS display panel illu- *
* minate                                            *
* - Gong sounds                                     *
*   Place DG/MAG No.1 (No.2) switch in MAG position.*
*   The leading dial on HSI [2] ([4]) returns to its*
*   initial heading                                 *
* - HDG warning light illuminates on both HSIs      *
* NOTE : When the heading flag disappears on HSI    *
*        [2], ([4]) attempt to engage FD1 (FD2).    *
*        Check that engagement is possible only when*
*        heading variation is approximately 4°    IF*
****************************************************
     |       |
     |       |    -----------------------------------------------
    OK    NOT OK--|Replace ISCU [8]                              |
     |       |    -----------------------------------------------
     |
****************************************************
* Inertia Signals Comparator Unit is operational   *
****************************************************
```

INTENTIONALLY BLANK

R

THE FOUR WARNING LIGHTS ON WARNING INDICATOR ARE NOT ILLUMINATED

On panel 15-215, trip circuit breaker L1001 (E14)
On panel 2-211, remove warning indicator [1] and check serviceability of fuse L1118

YES → Replace warning indicator [1]

NO → Replace fuse L1118

Replace warning indicator [1] — NOT OK → Ref. 33-14-00, Trouble Shooting

```
**************************************
* INS WARNING LIGHT ON MASTER WARNING *
* DISPLAY PANEL DOES NOT ILLUMINATE   *
**************************************

**************************************
* INS warning light only is not       *
* illuminated on MWS display panel    *
**************************************
     |                        |
    YES                       NO
     |                        |
------------------------------  -----------------------------------
| Replace caption light module| |All master warning lights are not |
| Ref. 33-00-00, Removal/     | |illuminated                       |
| Installation                | -----------------------------------
==============================
                                                 |
                                                YES
                                                 |
                                    ---------------------------------
                                    |Replace master warning display |
                                    |panel [6]                      |
                                    ---------------------------------
                                                 |
                                                 NO
                                                 |
                                    ---------------------------------
                                    |Ref. 33-15-00, Trouble Shooting|
                                    =================================
```

Chart 102

```
************************************
* CHECK ATT WARNING LIGHT ON ADIs    *
* DOES NOT ILLUMINATE                *
************************************

--------------------------------------
| Replace ISCU [8]                   |
--------------------------------------
                  |
                  NO
                  |
--------------------------------------
| Replace Captain ADI [3]             |
--------------------------------------
                  |
                  NOT OK
                  |
--------------------------------------
| Replace F/O ADI [5]
--------------------------------------
```

Chart 103

```
*************************************
* HDG WARNING LIGHT ON HSIs DOES NOT *
* ILLUMINATE                         *
*************************************

----------------------------------------
| Replace ISCU [8]                     |
----------------------------------------
                  |
                  NO
                  |
----------------------------------------
| Replace Captain HSI [2]              |
----------------------------------------
                  |
                NOT OK
                  |
----------------------------------------
| Replace F/O HSI [4]                  |
----------------------------------------
```

Chart 104

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ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] Warning indicator ISCU		2-211	F141	Flight Compartment	34-45-15 R/I	34-45-08
[2] HSI		2-211	1F22	Flight Compartment	34-23-11 R/I	34-45-08
[3] ADI		2-211	1F23	Flight Compartment	34-23-12 R/I	34-45-08
[4] HSI		2-212	2F22	Flight Compartment	34-23-11 R/I	34-45-08
[5] ADI		2-212	2F23	Flight Compartment	34-23-12 R/I	34-45-08
[6] Master warning display panel		4-211	W254	Flight Compartment	33-15-12 R/I	33-15-02
[7] Circuit Breaker		2-213	F4	Map Ref F7	24-50-00 R/I	34-45-01
[8] ISCU	Door 123BB	26-123	F1	Shelf 26-123	34-46-11 R/I	34-45-08
[9] Circuit Breaker		2-213	1C20	Map Ref C5	24-50-00 R/I	22-10-01
[10] INS - CDU		7-211	1F11	Flight Compartment	34-45-13 R/I	34-45-02
[11] Circuit Breaker		2-213	1F21	Map Ref B6	24-50-00 R/I	34-45-01
[12] Circuit Breaker		13-216	2C20	Map Ref A17	24-50-00 R/I	22-10-06

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF.	
					MAINT. TOPIC	WIRING DIAGRAM
[13] INS-CDU		7-211	2F11	Flight Compartment	34-45-13 R/I	34-45-02
[14] Circuit Breaker		13-216	2F21	Map Ref C15	24-50-00 R/I	34-45-01
[15] Circuit Breaker		2-213	3F15	Map Ref D7	24-50-00 R/I	34-45-01
[16] INS-CDU		9-211	3F11	Flight Compartment	34-45-13 R/I	34-45-02
[17] Circuit Breaker		2-213	1F15	Map Ref B7	24-50-00 R/I	34-45-01
[18] Circuit Breaker		13-216	2F15	Map Ref C13	24-50-00 R/I	34-45-01

Component Identification
Table 101

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

(3) Place INS systems in operation (Ref. 34-45-00, Adjustment/Test).

(4) Check that the following circuit breakers are closed :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
INS COMPTR SUP & IND		F 5	G15
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1SP PLT SW SUP		1F 26	G17
AUDIO WARN SYS SUP 1		W 371	M21
MWS SUP 2		W 252	N21
INS COMPTR SUP 2	2-213	F 3	A 6
ADI 1ST PLT INS 1 SUP		1F 15	B 7
ADI PLTS INS 3 SUP & IND		3F 15	D 7
HSI TRUE 1ST PLT INS 1 SUP IND		1F 21	B 6
INS 3 26V SUP		3F 30	A 7
INS 1 HTR SUP		1F 14	E 6
INS 1 SUP		1F 20	F 6
INS COMPTR SUP 1		F 4	F 7
FLT CONT & NAV BUS 14XS		X 355	H 2
AUDIO WARN O/SPEED SUP 2	5=213	W 373	C17

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
MWS SUP 2		W 251	D15
INS 3 SUP	13-215	3F 20	A 7
INS 3 HTR SUP		3F 14	C 7
PLT'S LT TEST SUP	15-215	L1001	E14
NAV INST BUS 13XS	13-216	X 345	G 4
INS COMPTR SUP 3		F 2	B15
ADI 2ND PLT INS2 SUP IND		2F 15	C13
HSI TRUE 2ND PLT INS 2 SUP IND		2F 21	C15
INS 2 SUP		2F 20	D14
INS 2 HTR SUP		2F 14	G15
NAV/INS 2ND PLT SW SUP	15-216	2F 34	C21
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21

C. Test

(1) On panel 5-211, place the RAD/INS switches in INS position.

(2) On Captain instrument panel place switches :

ATT INS1/ATT INS3 in ATT INS1 position.
NAV INS1/NAV INS2 in NAV INS1 position.
B COMP1/COMP2 in COMP1 position.

(3) On First Officer instrument panel place switches :

ATT INS2/ATT INS3 in ATT INS2 position.
NAV INS1/NAV INS2 in NAV INS2 position.
B COMP1/CIMP2 in COMP2 position.

- On Captain instrument panel, INS1, INS2 and INS3 warning lights on ISCU warning indicator are illu-
B minated, they extinguish when NAV is selected on
B associated MSU.

(4) Check of warning lights :

(a) On LH side console, 12-211, place and hold LO-
B HI-TEST switch L 1007 in TEST position.

On Captain instrument panel
- Red warning lights INS1-2 and 3 and amber warning light INS COMP on ISCU warning indicator (2-211) illuminates. Check that covers can mask illuminated warning lights.

B - Amber warning light HDG on CAPT HSI illuminates.

B - Amber warning light CHECK ATT on CAPT ADI illuminates.

Release switch, warning lights extinguish.

(b) On panel 5-212, RH side console, place and hold
B LO-HI-TEST L 1009 switch in TEST position.
B - HDG amber warning light on First Officer HSI
B and ATT on F/O ADI illuminate.
Release switch, warning lights extinguish.

(c) On panel 4-211, press LTS TEST push button on
B master warning panel (W254).
- All warning lights illuminate (check particularly INS warning light).
Release push button, all warning lights extinguish.

(5) Check of instrument attitude monitoring on ADI.

(a) Captain ADI

Press and hold TEST push button. Indicator self-test proceeds (Ref. 34-23-00, Adjustment/Test).
- Warning lights CHECK ATT on Captain and First Officer ADI illuminate when the instrument attitude comparison threshold is reached. Release TEST push button, warning lights extinguish.

(b) First Officer ADI

Procedure identical with (a).
- Warning lights CHECK ATT on Captain and First Officer ADI indicators illuminate when instrument attitude comparison threshold is reached. Release TEST push-button. Check that warning lights are extinguished.

(6) Check of instrument heading monitoring on HSI :

(a) Captain HSI

Press and hold TEST push-button. Indicator self-test proceeds
- HDG warning lights on Captain and First Officer

HSI indicators illuminate when instrument heading comparison threshold is reached. Release TEST push-button. Heading dial returns to initial position, HDG warning lights extinguish on HSI indicators.

(b) First Officer HSI

Procedure identical with (a)
- HDG warning lights on Captain and First Officer HSI illuminate when instrument heading comparison threshold is reached. Release TEST push-button. Check that warning lights are extinguished.

(7) ISCU fault warning

B (a) On panel 2-213, trip circuit breaker F7.
- On Captain instrument panel amber warning light INS COMP on ISCU warning indicator illuminates.
B Reset circuit breaker F7, INS COMP warning light extinguishes.

D. Close-Up

(1) Switch off INS systems by placing selector switches on the 3 MSU in OFF position.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(4) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS	2-213	X 355	H 2
NAV INST BUS	13-216	X 345	G 4

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Access Platform, Height of Access 3.46 m (11 ft. 4 in.)	

B. Prepare

(1) Position access platform at INS compartment.

(2) Open access door 123BB to INS compartment.

(3) Remove front panel from INS compartment.

(4) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(5) Switch on electronics rack ventilation system (Ref. 21-21-00).

R B (6) Switch on ADC's.

R B (7) Put INS systems into operation (Ref. 34-45-00, Adjustment/Test).

R B (8) Switch on Compass Couplers (Ref. 34-21-00, Adjustment/Test).

R B (9) Switch on Radio Altimeters (Ref. 34-42-00, Adjustment/Test).

R B (10) Engage Electric Trim, Autostabilizer and Antistall
R B systems.

R B (11) Engage both FD units (Ref. 22-10-00, Servicing).

R B (12) Check that the following circuit breakers are set :

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
INS COMPTR SUP & IND		F 5	G15
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1SP PLT SW SUP		1F 26	G17
AUDIO WARN SYS SUP 1		W 371	M21
MWS SUP 2		W 252	N21
INS COMPTR SUP 2	2-213	F 3	A 6
ADI 1ST PLT INS 1 SUP IND		1F 15	B 7
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
ADI PLTS INS 3 SUP & IND		3F 15	D 7
HSI TRUE 1ST PLT INS 1 SUP IND		1F 21	B 6
INS 3 26V SUP		3F 30	A 7
INS 1 HTR SUP		1F 14	E 6
INS 1 SUP		1F 20	F 6
AP/FD SYS 1 SUP		1C 20	C 5
INS COMPTR SUP 1		F 4	F 7
FLT CONT & NAV BUS 14XS		X 355	H 2
AUDIO WARN O/SPEED SUP 2	5-213	W 373	C17
MWS SUP 2		W 251	D15
INS 3 SUP	13-215	3F 20	A 7
INS 3 HTR SUP		3F 14	C 7
PLT'S LT TEST SUP	15-215	L1001	E14
AP/FD SYS 2 SUP	13-216	2C 20	A17
INS COMPTR SUP 3		F 2	B15
ADI 2ND PLT INS2 SUP IND		2F 15	C13
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP IND		2F 21	C15
INS 2 SUP		2F 20	D14
NAV INST BUS 13XS		X 345	G 4
INS 2 HTR SUP		2F 14	G15
NAV/INS 2ND PLT SW SUP	15-216	2F 34	C21
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21

C. Test

(1) On panel 5-211, place the RAD/INS switches in INS position.

(2) On Captain instrument panel place switches :

ATT INS1/ATT INS3 in ATT INS1 position.
NAV INS1/NAV INS2 in NAV INS1 position.
R B COMP1/COMP2 in COMP1 position.

(3) On First Officer instrument panel place switches :

ATT INS2/ATT INS3 in ATT INS2 position.
NAV INS1/NAV INS2 in NAV INS2 position.
COMP 1/COMP 2 in COMP 2 position.

- On Captain instrument panel, INS1, INS2 and INS3 warning lights on ISCU warning indicator are illu=
R B minated, they extinguish when NAV is selected on
R B associated MSU.

(4) Warning light check :

(a) On LH side console, 12-211 place and hold LO-HI-
R TEST switch L 1007 in TEST position.
- Red warning lights INS1, 2 and 3 and amber warning light INS COMP on ISCU warning indicator illuminate (2-211).
Check that covers can mask illuminated warning lights
- HDG amber warning light on HSI illuminates.
- CHECK ATT amber warning light on Captain ADI illuminates.
Release switch, warning lights extinguish.

(b) On RH side console, 5-212, place and hold LO-HI-
R TEST switch L 1009 in TEST position.
- HDG amber warning light on First Officer HSI illuminates.
- CHECK ATT amber warning light on First Officer ADI illuminates.
Release switch, warning lights extinguish.

(c) On 4-211, press LTS TEST push-button on master
R warning panel (W254).
= All warning lights illuminate (check in particular INS warning light).
Release push button, all warning lights extinguish

(5) ISCU fault warning

R B (a) On panel 2-213, trip circuit breaker F7 :

- On Captain instrument panel, amber warning light INS COMP on ISCU warning indicator illuminates.
R B Reset circuit breaker F7, INS COMP warning light extinguishes.

R B (b) On panel 2-213, trip circuit breaker A6 :
- On 2-211, INS COMP warning light on ISCU warning indicator illuminates. Reset circuit breaker A6,
R B then trip and reset circuit breaker F7, INS COMP warning light extinguishes.

R B (6) Check of instrument attitude monitoring on ADI.

R B (a) Captain ADI

R B Press and hold TEST push-button. Indicator self-
R B test proceeds (Ref. 34-23-00, Adjustment/Test).
R B - Warning lights CHECK ATT on Captain and First
R B Officer ADI illuminate when the instrument
R B attitude comparison threshold is reached. Re-
R B lease TEST push-button, warning lights extin-
R B guish.

R B (b) First Officer ADI

R B Procedure identical with (a).
R B - Warning lights CHECK ATT on Captain and First
R B Officer ADI indicators illuminate when instru-
R B ment attitude comparison threshold is reached.
R B Release TEST push-button. Check that warning
R B lights are extinguished.

R B (7) Check of instrument heading monitoring on HSI :

R B (a) Captain HSI

R B Press and hold TEST push-button. Indicator self-
R B test proceeds.
R B - HDG warning lights on Captain and First Officer
R B HSI indicators illuminate when instrument
R B heading comparison threshold is reached.
R B Release TEST push-button. Heading dial returns
R B to initial position, HDG warning lights extin-
R B guish on HSI indicators.

R B (b) First Officer HSI

R B Procedure identical with (a)
R B - HDG warning lights on Captain and First Officer
R B HSI illuminate when instrument heading compa-
R B rison threshold is reached. Release TEST push-

button. Check that warning lights are extinguished.

(8) Check of INS1 self-detected fault indications

(a) Trip successively the following circuit breakers (Ref. (b) (c).

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
AP/FD SYS 1 SUP	2-213	1C 20	C 5
ADI 1ST PLT INS1 SUP & IND	2-213	1F 15	B 7
HSI TRUE 1ST PLT INS1 SUP & IND		1F 21	B 6
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8

(b) HSI warning simulation

(b1) Trip circuit breaker 2-213 C5
Initially FDI disconnects with FDI flag and after a delay :
On Captain instrument panel
- INSI warning light illuminates on warning indicator.
On 4-211 on master warning panel :
- INS warning light illuminates.
- Gong sounds.
On 7-211 on CDU
- 03 Action Code with MAlfunction 24.

(b2) Reset circuit breaker 2-213 C5
- INSI and INS warning lights extinguish. Gong ceases.
- FDI flag clears. Re-engage FDI.
- Clear 03 on CDU.

(c) TRUE HEADING WARNING simulation

(c1) Trip circuit breaker 2-213 B6
Initially HDG flag in view on Captain HSI and after a delay :
On Captain instrument panel
- INS 1 warning light illuminates on warning indicator
On 4-211 on Master Warning panel
- INS warning light illuminates

R B - gong sounds.
R B On 7-211 on CDU
R B - 03 Action Code with malfunctions
R B 22 23 25

R B (c2) Reset circuits breaker 2-213, B6
R B - INS1 and INS warning lights extinguish.
R B - Gong ceases.
R B - HDG flag clears on Captain HSI
R B - Clear 03 on CDU

R B (9) Check of INS2 self-detected warning indications

R B (a) Trip the following circuit breakers (Ref. (b)
R B (c) (d).

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
AP/FD SYS2 SUP	13-216	2C 20	A17
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
ADI 2ND PLT INS2 SUP & IND	2-213	2F 15	C13

R B (b) HSI warning simulation

R B (b1) Trip circuit breaker 13-216-A17
R B Initially FD2 disconnects with FD2 flag
R B and after a delay :
R B On Captain instrument panel
R B - INS2 warning light illuminates on war-
R B ning indicator.
R B On 4-211 on master warning panel :
R B - INS warning light illuminates.
R B - Gong sounds.
R B On 7-211 on CDU
R B - 03 Action Code with Malfunction 24

R B (b2) Reset circuit breaker 13-216-A17
R B - INS2 and INS warning lights extinguish.
R B Gong ceases.
R B - FD2 flag clears. Re-engage FD2.
R B - Clear 03 on CDU

R B (c) TRUE HEADING WARNING simulation

R B (c1) Trip circuit breaker 13-216-C15
R B Initially HDG flag in view on Copilot HSI
R B and after a delay :
R B On captain instrument panel
R B - INS2 warning light illuminates on warning
R B indicator
R B On 4-211 on Master Warning panel
R B - INS warning light illuminates
R B - Gong sounds.
R B On 7-211 on CDU
R B - 03 Action Code with MAlfunction 22 23 25

R B (c2) Reset circuit breaker 13-216-C14
R B - INS2 and INS warning lights extinguish.
R B - Gong ceases
R B - HDG flag clears on Copilot HSI
R B - Clear 03 on CDU

(10) Check of INS3 self-detected warning indications

R B (a) Trip the following circuit breaker (Ref. (b) (c)
R B (d) :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADI PLTS INS3 SUP & IND	2-213	3F 15	D 7

(b) HSI WARNING - TRUE HEADING WARNING - PLATFORM HEADING WARNING simulation

R B (b1) Trip circuit breaker 2-213-D7
R B After a delay :
R B On Captain instrument panel
R B - INS3 warning light illuminates on warning
R B indicator.

R B On 4-211, master warning panel :
R B - INS warning light illuminates.
R B - Gong sounds.
R B On 7-211 on CDU
R B - 03 Action Code with Malfunctions 22, 23,
R B 24, 25.

R B (b2) Reset circuit breaker 2-213-D7

R B - INS1 and INS warning lights extinguish.
R B Gong ceases.

(11) Check of self-detected PRIMARY ATTITUDE WARNING (PAW) indications on INS1, INS2 and INS3

(a) This check is made by successively tripping circuit breaker 26 VAC ATTITUDE on two INS systems out of the three according to the following table.
This procedure is necessary to ascertain that INS warning light illuminates in case of a primary attitude warning self-detected by the INS and not for a comparison fault detected by the ISCU.

	CIRCUIT BREAKER TO BE TRIPPED			STATE OF WARNING LIGHTS ON WARNING INDICATOR		
B	2-213 B7	13-216 C13	2-213 D7	INS1	INS2	INS3
INITIAL CONDITION	ON	ON	ON	OFF	OFF	OFF
CHECK PAW INS 1	ON OFF	ON ON	OFF OFF	OFF ON	OFF OFF	ON ON
CHECK PAW INS 2	ON ON	ON OFF	OFF OFF	OFF OFF	OFF ON	ON ON
CHECK PAW INS 3	ON ON	OFF OFF	ON OFF	OFF OFF	ON ON	OFF ON

R (b) Reset circuit breakers (MAP REF C13, D7)

- INS1, INS2 and INS3 warning lights are extinguished on warning indicator.
- INS warning light on master warning panel extinguishes.
- Gong ceases.

B B - Clear 03 codes on CDU's and re-engage FD1 and FD2

(12) Heading monitoring in approach mode :

(a) Configuration

- Radio Altimeters are in operation
- On both VOR/ILS/DME control units select an ILS frequency (108°3)

B - Select LAND mode

R - Select Captains and Co-pilots RAD/INS switches to RAD.

(b) COMPASS COUPLER 1 heading
B Set Captains/Co-Pilots RAD/INS switch to RAD

- On COMPASS COUPLER control panel place DG/MAG No.1 switch in DG position.
- By means of DEC/INC No.1 switch, vary COMPASS COUPLER 1 heading by 6° to 8°. Release switch.
B FD1 switch disengages.
- Place DG/MAG No.1 switch in MAG position. Heading dial on Captain HSI returns to initial heading.
- HDG warning lights on both HSI illuminate.

When HDG flag disappears on Captain HSI, attempt to engage FD1 switch. Check that engagement is only possible when heading variation reaches approximately 4°.

(c) COMPASS COUPLER 2 heading

B Set Captains/Co-Pilots RAD/INS switch to RAD
- On COMPASS COUPLER control panel place DG/MAG No.2 switch in DG position.
- By means of DEC/INC No.2 switch vary COMPASS COUPLER 2 heading by 6° to 8°. Release switch.
- FD2 switch disengages.
- Place DG/MAG No.2 switch in MAG position. Heading dial on Captain HSI returns to initial heading.
- INS2 and INS warning lights illuminate and gong sounds.
- HDG warning lights on both HSI illuminate. When HDG flag disappears on First Officer HSI, attempt to engage FD2 switch. Check that engagement is only possible when heading variation reaches approximately 4°.

<u>NOTE</u> : Loss of LAND III capacity on COURSE SET comparison, ISCU fault and INS3 warning are covered in warning and landing display test.

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INERTIAL SIGNAL COMPARATOR UNIT (ISCU) - REMOVAL/INSTALLATION

1. General

The ISCU (FI) is installed in the equipment bay on shelf 26-123, in zone 123.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps/Plugs for Electrical	
Connectors	
Blanking Plates for Ventilation Outlets	
Access Platform, 3.46 m (11 ft. 4 in.)	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
INS COMPTR SUP & IND	1-213	F5	G15
INS COMPTR SUP2	2-213	F3	A 6
INS COMPTR SUP1		F4	F 7
INS COMPTR SUP3	13-216	F2	B15

(2) Position access platform.

(3) Open door 123BB to gain access to ISCU equipment bay.

(4) Remove access panel 123BZ to gain access to shelf 26-123

C. Remove

(1) Perform operations described in 34-00-00, paragraph 2.D.(1), Removal/Installation.

D. Preparation of Replacement Component

(1) Perform operations described in 34-00-00, paragraph 2.E., Removal/Installation.

E. Install

Perform operations described in 34-00-00, paragraph 2.F.(1), Removal/Installation.

F. Close-Up

(1) Remove safety clips and tags and reset circuit breakers tripped in 2.B.(1).

(2) Carry out an operational test of ISCU, (Ref. 34-46-00, Adjustment/Test).

(3) Install access panel 123BZ.

(4) Close access door 123BB.

(5) Remove access platform.

GROUND PROXIMITY WARNING SYSTEM - DESCRIPTION AND OPERATION

1. General

A. The ground proximity warning system (GPWS) provides the pilots with aural and visual warning of potentially dangerous flight paths relative to the ground. The GPWS processes radio altitude information from the No.1 low range radio altimeter (LRRA), altitude rate information from the No.1 central air data computer (CADC), and landing gear and nose droop position signals to provide warnings of the following hazards :

(1) Inadvertent descent close to the ground

(2) Level flight or too shallow climb towards rising terrain

(3) Excessive rate of descent

(4) Deliberate descent in unsuspected proximity to the ground

(5) Excessive deviation below the glide slope.

B. The GPWS consists of a ground proximity computer and a red warning light labelled "PULL-UP". In addition, an audible warning is iniated through the pilots interphone speakers.

C. Primary power for the system is 115 volts ac supplied from the No.2 Main bus in 13-215 CB panel labelled GRND PROXIMITY WARN AC SUP.

D. The CADC also supplies 26 volts ac as a reference voltage for the altitude rate circuits.

2. Computer

A. The ground proximity warning computer (GPWC) is rack mounted 6-215 racking JB LH FWD. The GPWC consists of a logic and power supply module, a comparator and closure warning module and audio modules.

3. Warning Indicator Lights

A. Two warning lights (red) labelled PULL UP are installed on the pilots panel. There is one light for each panel. They have a press to test feature which provides a system self-test when activated. Access to the light bulbs is provided by removing the lens cover.

B. The light flashes to provide a visual indication that the GPWC has generated a warning of an unsafe flight path

4. Aural Warning

A. Aural warning from the computer is fed via the audio warning unit to speakers in zones 212 and 211. It provides an aural indication that the GPWC has generated a warning of an unsafe flight path.

5. Operation

A. Functional Description

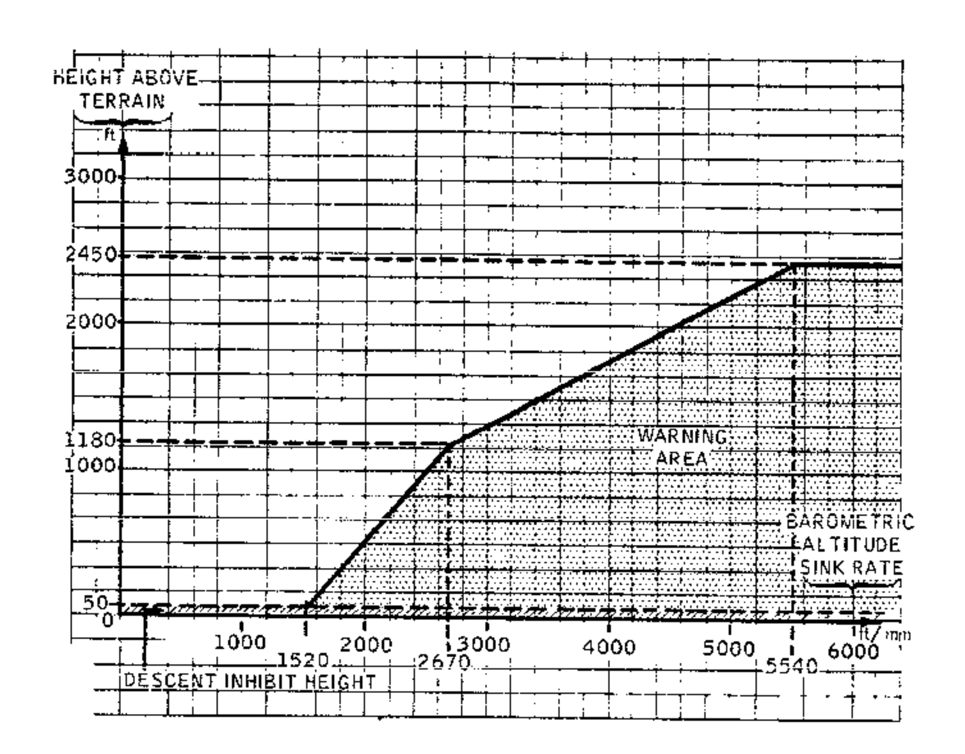
(1) The GPWS is operational when the following circuit breakers on CB panels 13-215, 15-215, 2-213, 13-216, are closed. GPWS, CADC, LRRA, VOR, GS, landing gear and nose droop.

(2) Signal inputs to the GPWC consist of radio altitude information from LRRA No.1, altitude rate information from CADC No.1 and glide slope deviation information from the VOR/ILS systems. The radio altitude signal is a dc voltage which is a function of airplane height above ground level and its maximum working height of 2500 feet. The barometric rate signal is ac with a scale of 250 mv/1000 fpm altitude change. This rate signal is in phase with the 26 volt ac reference from the CADC during ascent and out of phase during descent. The glide slope deviation signal provides a low level sensitivity of 1 volt/deviation dot.

(3) Binary inputs to the GPWC consist of a landing gear position signal and 28 volt dc radio altimeter valid and air data computer valid signals. The landing gear position signal is open when the landing gear is in any position other than down and locked and ground potential when the landing gear is down and locked. The nose droop position signal is ground potential when the nose is positioned between 0° -
R 5 1/2° and open when the nose is positioned between 5 1/2° - 12 1/2°

(4) The GPWC processes the input signals to provide warning outputs during the following flight conditions:

(a) Excessive sink rate warning (Mode 1)
(Ref. Fig. 001)



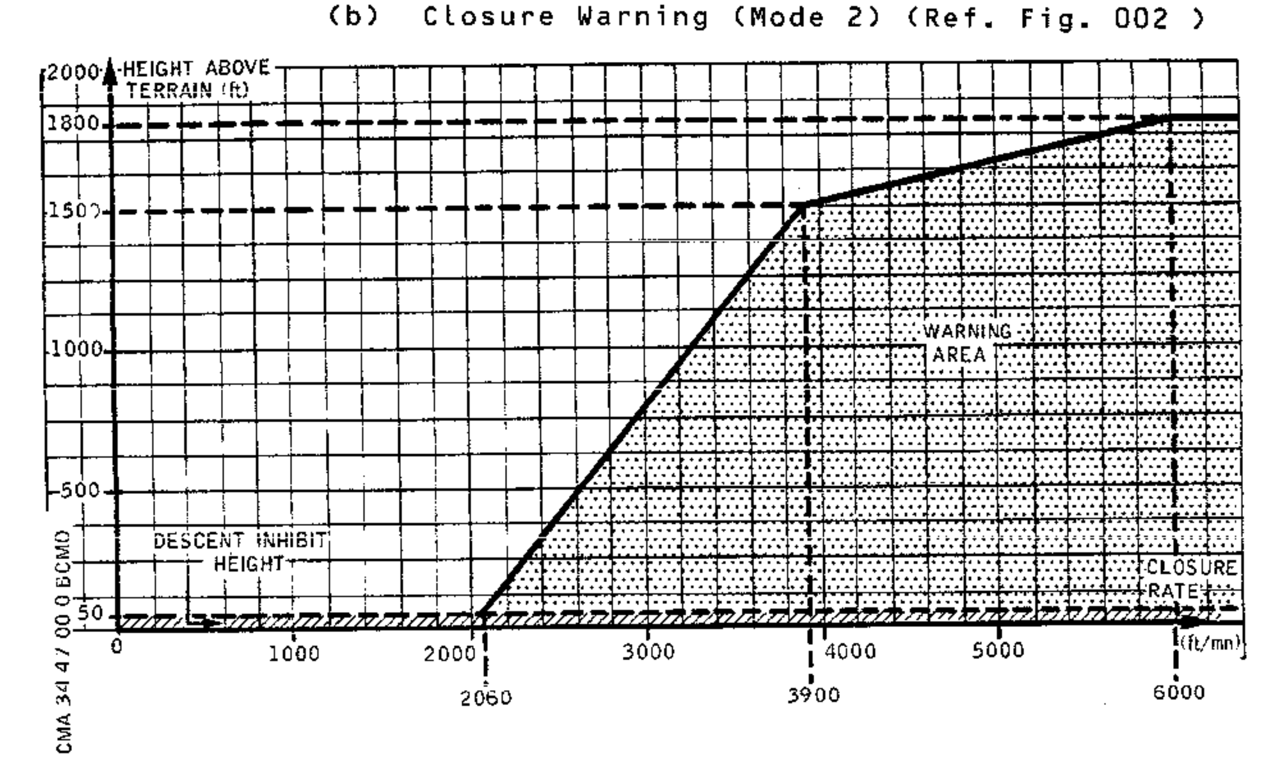
Mode 1 : Warning envelope Excessive Sink Rate
Figure 001

(a1) The barometric sink rate and the 2400 foot radio altitude detector signal to switch the gate on and indicate excessive sink rate.

(a2) The system provides a minimum warning time of approximately 30 seconds at radio altitude between 2450 and 1180 feet prior to predicted terrain impact. Less warning time is provided below 1180 feet of radio altitude.

CMA 34 47 00 0 BAMO

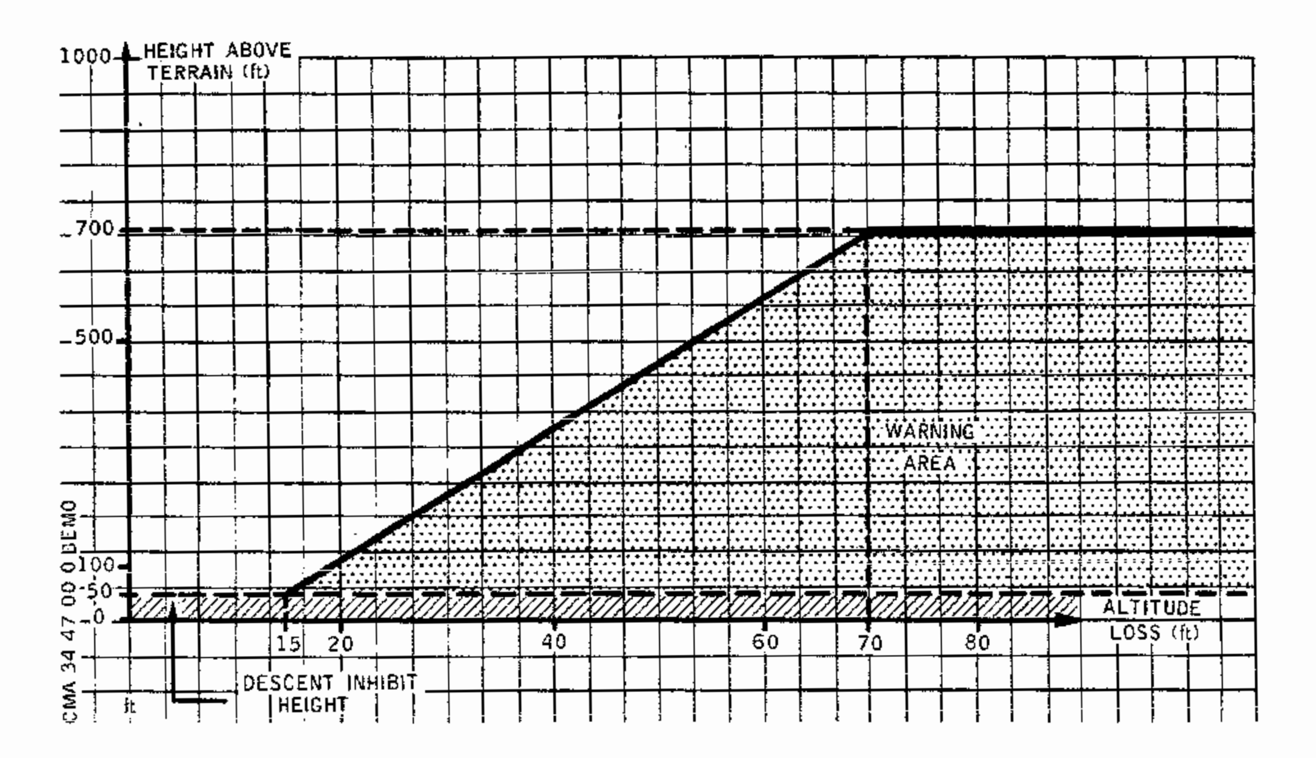
(b) Closure Warning (Mode 2) (Ref. Fig. 002)



Mode 2 : Warning Envelope Closure Warning
Figure 002

(b1) The terrain closure rate detector combines the output of the radio altitude linearised, nose logic and the unsafe descent rate to provide a warning as shown in the curve.

(c) Negative climb rate warning (Mode 3)
(Ref. Fig. 003)



Mode 3 - Warning Envelope Negative Climb Rate
Figure 003

(c1) A warning is provided when the airplane is at a less than 700 foot terrain clearance, landing gear or nose up in take off/landing mode, and a barometric altitude loss is detected. The altitude loss required to activate the GPWS warning varies with the height of the aircraft at the time when inadvertent descent occurs. At a climbout altitude of 100 feet, any loss of altitude will activate a warning. At 700 feet, a altitude loss of 70 feet will activate warning.

(c2) The logic is set to take off/landing mode when the radio altitude is less than 700 feet, with landing gears down and nose down.

(d) Unsafe terrain clearance warning (Mode 4)
(Ref. Fig. 004)

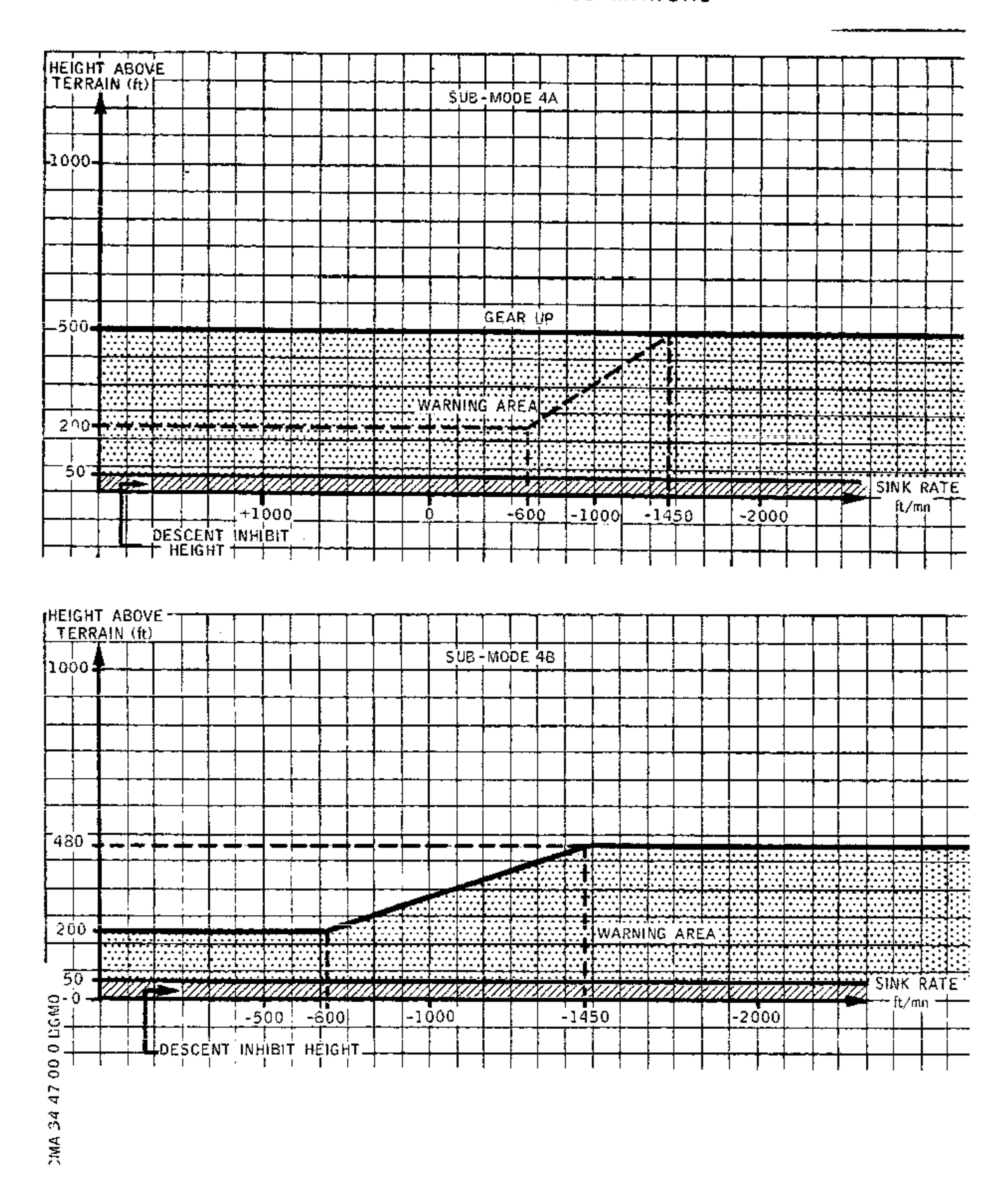
(d1) A warning is provided when the aircraft is in cruise mode 500 feet with gears up, or between 200 - 500 feet in cruise mode with gears down and nose up and an unsafe descent rate is detected, or in cruise mode at a radio altitude below 200 feet with gears down and nose not in landing position.

(d2) The logic is set to cruise mode when the radio altitude is greater than 700 feet.

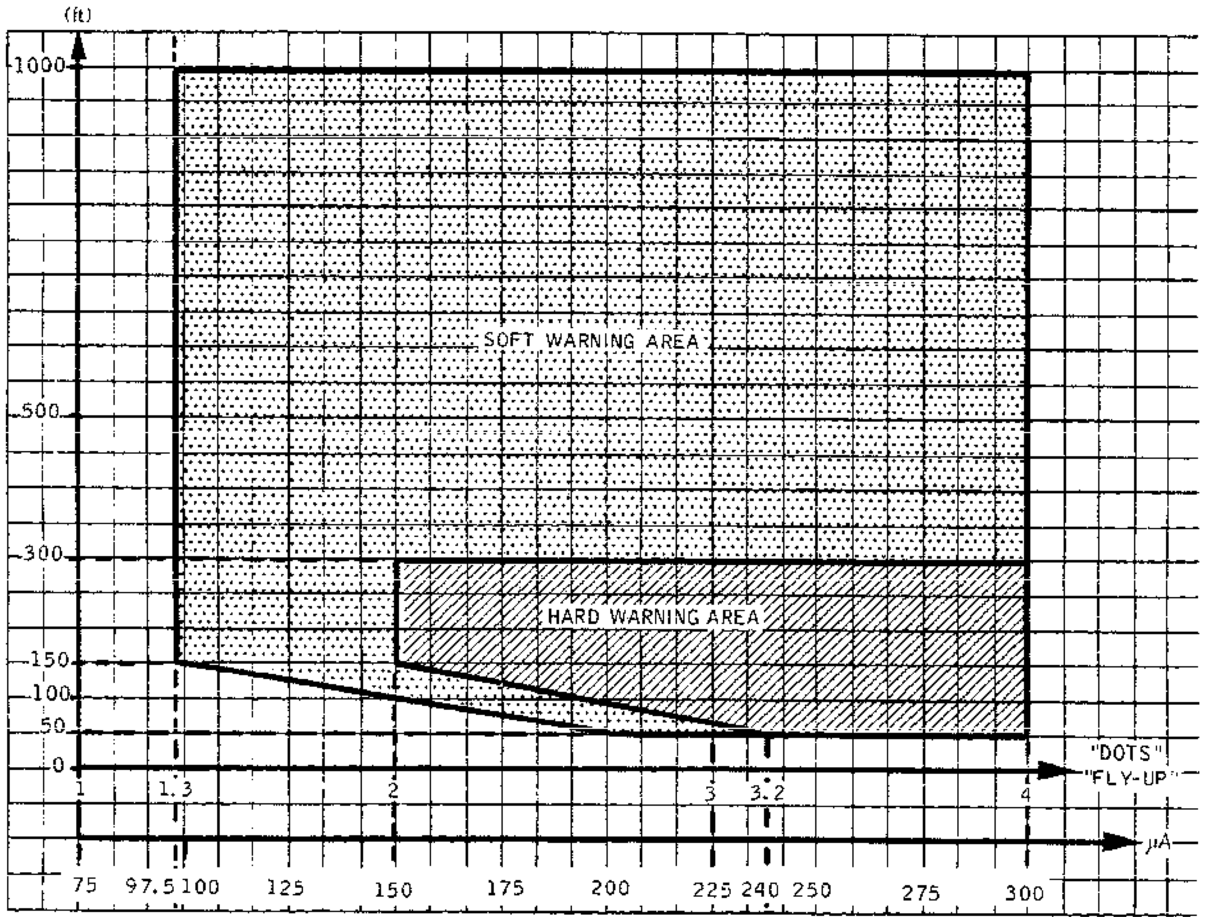
(e) Glide slope deviation warning (mode 5)
(Ref. Fig. 005)

R (e1) A soft glide slope warning is provided if the deviation of the aircraft below the glide-slope exceeds 1.3 dots when the aircraft is between 1000 and 150 feet of radio altitude. A hard warning is provided if the deviation of the aircraft below the glide slope exceeds 2 dots when the aircraft is between 300 and 150 feet of radio altitude.

(e2) In order to allow the pilot to purposely descend below the glide slope without triggering a warning, the glide slope warning mode may be inhibited by pressing either "PULL UP" indicator when the radio altitude is below 1000 feet and the hard warning is not in progress. The glide slope warning cannot be inhibited when the hard warning is on.



Mode 4 : Warning Envelope Unsafe Terrain Clearance
Figure 004



CMA 34 47 00 0 CJMO

Mode 5 : Warning Envelope Glide Slope Deviation
Figure 005

(5) The GPWC warning outputs consist of the following:

(a) A synthesised voice over the cockpit loudspeaker says "Pull Up - Whoop - Whoop - Pull Up".

(b) Two lights, one per pilots panel which flash when an unsafe flight condition is present.

(c) An audio warning of mode 5 penetration.

(6) The ground proximity warning output for all modes is inhibited whenever the stall warning system is activated.

(7) System self test may be initiated by pressing the PULL UP indicator. During self test the PULL-UP light flashes, and both aural warnings are broadcast. The "Pull Up - Whoop - Whoop" may be repeated up to seven times.

(8) Self test may also be initiated by pressing the test switch on computer front panel. In addition the aural and visual warnings at a reduced level occur as described above.

R

R (9) One synthetic voice from the TCAS computer (S85) to
R the audio mixing box (S89) is embodied at the audio
R warning unit (W381) for the Pilot and Co-Pilot
R loudspeaker. The GPWS has priority over TCAS. The
R TCAS computer contains an inhibition circuit which
R allows the GPWS to override TCAS aural warnings.

B. Controls

(1) The GRND PROXIMITY WARN AC SUP circuit breaker on panel 13-215 controls the 115 volt ac power to the computer.

(2) The GRND PROXIMITY WARN DC SUP circuit breaker on panel 15-215 controls the 28 volt dc potential to the flashing circuit and warning lamps.

(3) System control includes the ground proximity warning system test switch.

GROUND PROXIMITY WARNING SYSTEM (GPWS) - TROUBLE SHOOTING

WARNING : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of the trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption, that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Prepare

A. With aircraft on wheels or on jacks with RH main landing gear downlocked.

B. On centre console 9-211, make certain that on ADC control panels the ADC ON/OFF switches are in OFF position and test selector switches in NORM position.

C. Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

D. Switch on electronics rack ventilation system (Ref. 21-21-00).

E. Place droop nose in 0° or 5° position (Ref. 27-61-00, Adjustment/Test).

F. Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH UC WEIGHT SW "A" & DOWNLOCK SYS SUP	1-213	G 295	M18
AUDIO WARN SYS SUP 1		W 371	M21
ADC 1 28V SUP		1F 74	P12
ADC 1 26V SUP	2-213	1F 78	A 2
1ST PLT VSI SUP		1F 97	A 3
1ST PLT ADC INST SUP		1F 75	B 3
RAD ALT 1 SUP		1S 56	D 8
ADC 1 115V SUP		1F 73	F 3
FLT CONT & NAV BUS 14XS		X 355	H 2
AUDIO WARN SYS SUP 2	5-213	W 372	C17
GRD PROXIMITY WARN AC SUP	13-215	W 631	G 4
RAD ALT 1 & 2 IND	15-215	S 57	C 5
LIGHT TEST		L1001	E14
GRD PROXIMITY WARN DC SUP		W 632	G 7
NAV INST BUS 13XS	13-216	X 345	G 4

G. On LH electronics rack, remove panel 215BC to gain access to shelf 6-215.

3. Trouble Shooting

```
****************************************************
* On Captain console 12-211, place and hold D/B    *
* LIGHT (LO-HI-TEST) in TEST position, PULL-UP warn-*
* ing light on Captain instrument panel comes on.  *
*                                              IF *
****************************************************
   ||    |
   ||    |                 ---------------------------------------------------
   ||    |-NOT OK--| Captain PULL-UP warning light (1) comes on      |
   ||              | dimly. Ref. Chart 101                           |
   ||                ---------------------------------------------------
****************************************************
* On First Officer console 5-212, place and hold D/B*
* LIGHT (LO-HI-TEST) in TEST position, PULL-UP warn-*
* ing light on First Officer instrument panel comes *
* on                                            IF *
****************************************************
   ||    |           ---------------------------------------------------
   ||    |         | Captain PULL-UP warning light (2) comes on      |
   ||    |-NOT OK--| dimly.                                          |
   ||              | Ref. Chart 101                                  |
   ||                ---------------------------------------------------
****************************************************
* On centre console 9-211 place ADC 1 ON/OFF switch *
* in ON position. After 30 seconds, press and ret-  *
* ease amber ADC 1 warning light.                   *
* Press and hold for 10 seconds Captain or First    *
* Officer red PULL-UP warning light :               *
* - aural warning sounds in audio warning system    *
*   loudspeakers                                    *
* - Captain and First Officer PULL-UP warning lights*
*   flash.                                          *
*                                              IF *
****************************************************
   ||    |           ---------------------------------------------------
   ||    |         | No aural warning or flashing of PULL-UP warning|
   ||    |-NOT OK--| lights.                                         |
   ||    |         | Ref. Chart 102                                  |
   ||    |           ---------------------------------------------------
   ||    |
   ||    |
   ||    |
   ||    |
   ||    |
   ||    |
   ||    |
```

```
 ||    |
 ||    |         ------------------------------------------------------
 ||    |         | No aural warning in audio warning loudspeakers,|
 ||    |-NOT OK--| PULL-UP warning lights flash.                  |
 ||    |         | Ref. Chart 103                                 |
 ||    |         ------------------------------------------------------
 ||    |
 ||    |         ------------------------------------------------------
 ||    |         | In audio warning loudspeakers PULL-UP warning  |
 ||    |-NOT OK--| sounds, no GLIDESLOPE warning. Trip circuit    |
 ||    |         | breakers : W631, W632 and 1F97.                |
 ||    |         | Replace ground proximity warning computer [3]. |
 ||    |         ------------------------------------------------------
 ||    |
 ||    |         ------------------------------------------------------
 ||    |         | Captain and First Officer PULL-UP warning      |
 ||    |-NOT OK--| lights do not flash, but aural warning correct.|
 ||    |         | Ref. Chart 104                                 |
 ||    |         ------------------------------------------------------
 ||    |
 ||    |         ------------------------------------------------------
 ||    |         | One of PULL-UP warning lights (Captain or F/O) |
 ||    |         | does not flash but the other flashes.          |
 ||    |-NOT OK--| Ref. Chart 105                                 |
 ||              ------------------------------------------------------
 ||
*****************************************************
* Ground proximity warning system is operational.   *
*****************************************************
```

```
************************************
* PULL-UP WARNING LIGHT [1] OR [2]   *
* COMES ON DIMLY                     *
************************************

***************************************************
* Replace defective lamp. Ref. 33-14-00, Removal/   *
* Installation.                                     *
***************************************************

---------------------------------------------------
| Replace warning light assembly. Ref. 33-00-00,   |
| Removal/Installation                              |
---------------------------------------------------
```

Chart 101

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NO AURAL WARNING OR FLASHING OF PULL-UP WARNING LIGHTS.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

On shelf 6-215, make certain on ground proximity warning computer that warning mode annunciators are not white.
Press RESET push-button on computer front panel, annunciators change to black.

- NO → Check 115VAC at output of circuit breaker [4].
  - NO → Replace circuit breaker [4]
  - YES → Trip circuit breakers W631, W632 and 1F97. Replace ground proximity warning computer [3].
- YES → Press and hold SELF-TEST push-button on computer front panel [3], the system status indicators come on and go off according to a set sequence.
  - NO → Self-test does not run. Trip circuit breakers : W631, W632 and 1F97. Replace ground proximity warning computer [3].
  - NOT OK → A system status indicator remains on : Check operational status of peripheral system corresponding to illuminated indicator

Chart 102

```
****************************************
* NO AURAL WARNING IN AUDIO WARNING    *
R  * LOUDSPEAKERS, PULL-UP WARNING        *
* LIGHTS FLASH                         *
****************************************


*****************************************************
* Check operation of audio warning system (Ref. 31- *
* 23-11, Adjustment/Test).                          *
*****************************************************
            |                                  |
            NO                                 YES
            |                                  |
------------------------------------------------------------------------
| Check audio warning system      || Trip circuit breakers :           |
| circuitry (Ref. 31-23-00,       || W631, W632 and 1F97               |
| Trouble Shooting).              || Replace ground proximity warning  |
----------------------------------| computer [3].                      |
                                   ------------------------------------
```

Chart 103

CAPTAIN AND FIRST OFFICER PULL-UP WARNING LIGHTS DO NOT FLASH, AURAL WARNING SOUNDS CORRECTLY.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

Check 28VDC at output of circuit breaker [5].

YES:

Trip circuit breakers :
W631, W632 and 1F97
Replace ground proximity warning computer [3]

NO:

Replace circuit breaker [5]

Chart 104

ONE PULL-UP WARNING LIGHT (CAPTAIN OR F/O) DOES NOT FLASH WHILE THE OTHER FLASHES CORRECTLY	GROUND EQUIPMENT REQUIRED	
	DESCRIPTION	PART NO.
	MULTIMETER	

On Captain side console 1-211, remove panel 211GS check with multimeter that at terminal 5 of flasher unit [6] or [7] there is -28VDC (ground)

- YES: Check with multimeter that at terminal 2 of flasher unit [6] or [7] there is 28V (2Hz alternation)..
  - YES: Replace Captain or First Officer PULL-UP warning lights [1] or [2]. Ref. 33-14-00, Trouble Shooting and 33-00-00 Removal/Installation.
  - NO: Trip circuit breaker [5]. Replace flasher unit [6] or [7].
- NO: Trip circuit breakers : W631, W632 and 1F97 Replace ground proximity warning computer. [3].

Chart 105

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] PULL-UP warning light		2-211	W636	Flight Compart-ment		34-47-11 34-47-12
[2] PULL-UP warning light		2-212	W637	Flight Compart-ment		34-47-11 34-47-12
[3] Ground pro-ximity warning computer	215BS	6-215	W633	LH Elec-tronics Rack	34-47-12 R/I	34-47-11 34-47-12
[4] Circuit breaker 115VAC		13-215	W631	Map Ref. G 4	24-50-00 R/I	34-47-11 34-47-12
[5] Circuit breaker 28VDC		15-215	W632	Map Ref. G 7	24-50-00 R/I	34-47-11 34-47-12
[6] Flasher unit	211GS	1-211	W634	Flight Compart-ment	34-47-11 R/I	34-47-11 34-47-12
[7] Flasher unit	211GS	1-211	W635	Flight Compart-ment	34-47-11 R/I	34-47-11 34-47-12

Component Identification
Table 101

GROUND PROXIMITY WARNING SYSTEM (GPWS) - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) With aircraft on ground or on jacks with RH main landing gear downlocked.

(2) Place droop nose in 0° or 5° position. (Ref. 27-61-00, Adjustment/Test).

(3) Connect electrical-ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(4) Switch on electronics rack ventilation system (Ref. 21-21-00).

(5) On centre console 9-211, make certain that on ADC control panel the ADC ON-OFF switches are in OFF position and test selector switches are in NORM position.

(6) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH UC WEIGHT SW "A" & DOWNLOCK SYS SUP	1-213	G 295	M18
AUDIO WARN SYS SUP1		W 371	M21
ADC1 28V SUP		1F 74	P12
ADC1 26V SUP	2-213	1F 78	A 2
1ST PLT VSI SUP		1F 97	A 3
1ST PLT ADC INST SUP		1F 75	B 3
RAD ALT 1 SUP		1S 56	D 8
ADC1 115V SUP		1F 73	F 3
FLT CONT & NAV BUS 14XS		X 355	H 2
AUDIO WARN SYS SUP2	5-213	W 372	C17

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
GRD PROXIMITY WARN AC SUP	13-215	W 631	G 4
RAD ALT 1 & 2 IND	15-215	S 57	C 5
LIGHT TEST		L1001	E14
GRD PROXIMITY WARN DC SUP		W 632	G 7
NAV INST BUS 13XS	13-216	X 345	G 4

C. Test

(1) Warning light check.

NOTE : This check is not applicable to aircraft 204 (G-N81AC).

(a) On LH side panel 12-211 :

(a1) Place and hold D/B LIGHT (LO-HI-TEST) switch in TEST position, PULL-UP warning light on Captain instrument panel 2-211 comes on.

(a2) Release D/B LIGHT (LO-HI-TEST) switch, Captain PULL-UP warning light goes off.

(b) On RH side panel 5-212 :

(b1) Place and hold D/B LIGHT (LO-HI-TEST) switch in TEST position, PULL-UP warning on First Officer instrument panel 2-212 comes on.

(b2) Release D/B LIGHT (LO-HI-TEST) switch, First Officer PULL-UP warning light goes off.

(2) System self-test.

(a) On centre console 9-211, place ADC1 ON-OFF switch in ON position.

(a1) After approximately 30 seconds, press and release amber ADC1 warning light which remains off.

(b) On Captain instrument panel 2-211 :

(b1) Press and hold red PULL-UP warning light for

approximately 10 seconds :
- both PULL-UP warning lights flash (Captain and First Officer instrument panels)
- aural warning sounds in audio warning loud-speakers (Glide slope once followed by PULL UP several times).

(b2) Release red PULL-UP warning light.
- both PULL-UP warning lights go off.
- aural warning ceases.

(3) Check of validity signals

(a) On instrument panel 2-211, Captain radio altimeter indicator :

(a1) Turn triangle marked knob clockwise

(a2) Press and hold TEST push-button and simultaneously press PULL-UP warning light :
- GPW system test does not operate.

(a3) Release TEST push-button on radio altimeter indicator.

(b) On centre console 9-211 place ADC1 ON-OFF switch in OFF position and simultaneously press PULL-UP warning light (Panel 2-211) :

(b1) Warning flag appears on Captain vertical speed indicator.

(b2) GPW system test does not operate. (Only GLIDE SLOPE warning sounds once).

(c) GLIDE valid signal will be checked during functional test, paragraph 2-C-(X)-(X).

(d) On instrument panel 2-211, radio altimeter, turn triangle marked knob counterclockwise.

D. Close-Up

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2

SERVICE		PANEL	CIRCUIT BREAKER	MAP REF.
NAV INST BUS	13XS	13-216	X 345	G 4

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit. (Ref. 24-41-00, Servicing).

2. Functional test

A. Equipment and materials.

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Headsets for Interphone	TE2037000
Radio Altimeter Ground Test Unit (TRT-AHV5-018)	
VOR/ILS Ground Test Unit	
Pressure Sensor Simulator	87209455
Hydraulic Ground Power Unit	

B. Prepare

(1) With aircraft on ground or on jacks with RH main landing gear downlocked.

(2) Place, or make certain that droop nose is placed in 0° or 5° position (Ref. 27-61-00, Adjustment/Test).

(3) On centre console 9-211, make certain on ADC control panel that ADC ON-OFF switches are in OFF position and that test selector switches are in NORM position.

(4) Position and correct radio altimeter ground test unit, (Ref. 34-42-00, Adjustment/Test) paragraph 2, functional test, radio altimeter 1.

(5) On LH electronics rack 215 remove panel 215BS. On ADC1 TEST socket, connect pressure sensor simulator.

(6) Place VOR ILS ground test unit in flight compartment, (Ref. 34-36-00, Adjustment/Test) paragraph 2, functional test.

(7) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(8) Switch on electronics rack ventilation system (Ref. 21-21-00).

(9) Make certain that the following circuit breakers are

set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DEV 1 & 2 1ST PLT SW SUP	1-213	1R 38	G14
RAD/INS 1ST PLT SW SUP		1F 26	G17
No.1 INPH SUP		R 89	K19
RH UC WEIGHT SW "A" & DOWNLOCK		G 295	M18
AUDIO WARN SYS SUP 1		W 371	M21
ADC1 28V SUP		1F 74	P12
STICK SHAKER SUP		W 513	P15
NOSE 71/2° CONT		M 12	Q16
VISOR SERVICES B SYS CONT		M 14	Q18
ADC 1 26V SUP	2-213	1F 78	A 2
1ST PLT VSI SUP		1F 97	A 3
1ST PLT ADC INS SUP		1F 75	B 3
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RAD ALT 1 SUP		1S 56	D 8
ADC 1 115V SUP		1F 73	F 3
ILS VHF NAV 1 SUP		1R 25	G 6
FLT CONT & NAV BUS 14XS		X 355	H 2
NO 2 INPH SUP	3-213	R 90	H 2
AUDIO WARN SYS SUP 2	5-213	W 372	C17
GRD PROXIMITY WARN AC SUP	13-215	W 631	G 4
RAD ALT 1 & 2 IND	15-215	S 57	C 5
LIGHT TEST		L1001	E14
VISOR & NOSE CONT		M 11	F 8
VISOR & NOSE IND		M 15	F 9
GRD PROXIMITY WARN DC SUP		W 632	G 7
NAV INST BUS 13XS	13-216	X 345	G 4
VISOR SERVICES "B" SYS CONT	15-216	M 16	D18
INPH SUP	25-216	R 102	D 2

(10) On LH side console, connect a boomset to Captain jack panel.

(11) On panel 20-215, connect a boomset to 2nd supernumerary jack panel

(12) Connect a ground service telephone with headset to ground service jack, and connect ground service jacks to flight compartment by means of interphone (Ref. 23-41-00, Adjustment/Test).

(13) On panel 5-211, on Captain VOR/ILS/DME control unit, select VOR/ILS ground test unit frequency.

(14) Adjust VOR/ILS ground test unit operating in GLIDE mode to obtain on Captain HSI a deflection of one point upwards on GLIDE pointer (deviation 75 microamperes).

C. Tests

(1) Indicator light check.

Repeat operations in paragraph 1-C-(1), Operational Test.

(2) System self-test

Repeat operations in paragraph 1-C-(2), Operational Test.

(3) Check of valid signals

Repeat operations in paragraphs 1-C-(3)-(a) and 1-C-(3)-(b), Operational Test.

(4) Check of excessive rate of descent with respect to terrain.

(a) On radio altimeter ground test unit place:

(a1) SIMULATOR ON-OFF switch in ON position.

(a2) Turn Plus-Minus potentiometer in Plus direction so that altitude displayed on Captain radio altimeter indicator is 1000 ft.

(b) On pressure sensor simulator, adjust ALTITUDE knob to obtain on Captain vertical speed indicator an indication Vz equal to or greater than -3000 ft/min :

(b1) On instrument panels 2-211 and 2-212, PULL-UP warning lights flash.

(b2) PULL-UP aural warning sounds.

(c) On pressure sensor simulator, cease adjustment of ALTITUDE knob :

(c1) On Captain and First officer instrument panels :
- PULL-UP warning lights go off
- indicated vertical speed Vz=0.

(c2) PULL-UP aural warning ceases.

(5) Check of negative rate of climb after take off or go around.

(a) On radio altimeter ground test unit, select on Captain radio altimeter 0 ft altitude, then increase to 560 ft, by means of Plus-Minus potentiometer.

(b) On panel 1-213 trip circuit breaker (RH UC WEIGHT SW "A" & DOWNLOCK SYS SUP) G295, map ref. M18.

(c) On pressure sensor simulator adjust ALTITUDE knob to obtain on Captain vertical speed indicator a negative Vz (do not exceed -500 ft/min) :

(c1) PULL-UP warning lights flash on Captain and First officer instrument panels.

(c2) PULL-UP aural warning sounds.

(d) On radio altimeter ground test unit adjust Plus-Minus potentiometer to obtain an altitude of 750 ft. on Captain radio altimeter :

(d1) PULL-UP aural warning ceases, PULL-UP warning lights go off.

NOTE : To reactivate the warning, adjust Plus-Minus potentiometer on radio altimeter ground test unit to obtain minimum 50 ft. on Captain radio altimeter. Again adjust potentiometer from 50 ft. to 600 ft.

(6) Check of approach with incorrect landing gear configuration.

(a) With circuit breaker G295 still tripped, adjust Plus-Minus potentiometer on rack altimeter ground test unit to obtain 400 ft. altitude on Captain radio altimeter indicator :

(a1) PULL-UP aural warning sounds

(a2) PULL-UP warning lights flash on Captain and First officer instrument panel.

(b) On panel 1-213, trip circuit breaker RH UC WEIGHT SW "A" & DOWNLOCK SYS SUP, G295, Map Ref. M18.

(b1) PULL-UP aural warning ceases, PULL-UP warning lights go off.

(c) Adjust Plus-Minus potentiometer on ground test unit to obtain 150 ft. altitude on Captain radio altimeter indicator.

(c1) PULL-UP aural warning sounds.

(c2) PULL-UP warning lights flash on Captain and First officer instrument panels.

(d) Place droop nose in 12.5° position (Ref. 27-61-00, Adjustment/Test).

(d1) PULL-UP aural warning ceases, PULL-UP warning lights go off.

(e) Place droop nose in 0° or 5° position (Ref. 27-61-00, Adjustment/Test).

(e1) PULL-UP aural warning and PULL-UP warning lights on Captain and First officer instrument panels are activated for approximately 12 seconds after droop nose operation.

(f) Adjust Plus-Minus potentiometer on ground test unit to obtain 0 ft on Captain radio altimeter indicator :

(f1) Below 50 ft. PULL-UP aural warning ceases and PULL-UP warning lights go off.

(7) Check of excessive deviation under GLIDE beam.

(a) Place droop nose in 12.5° position (Ref. 27-61-00, Adjustment/Test).

(b) Make certain on Captain HSI that GLIDE pointer indicates one point upwards (75 microamperes deviation supplied by VOR/ILS ground test unit).

(c) Adjust Plus-Minus potentiometer on radio altimeter ground test unit to obtain 1200 ft. on Captain radio altimeter indicator, then decrease altitude

to 400 ft.

(d) Adjust VOR/ILS ground test unit operating in GLIDE mode to obtain on Captain HSI maximum deflection upwards on GLIDE pointer (200 microamperes deviation).

(d1) GLIDE SLOPE aural warning operates.

(d2) PULL-UP aural warning does not operate.

(d3) PULL-UP warning lights are off.

(e) Adjust VOR/ILS ground test unit operating in GLIDE mode to obtain on Captain HSI deflection of one point upwards on GLIDE pointer (deviation 75 microamperes).

(e1) GLIDE SLOPE aural warning ceases.

(f) Adjust VOR/ILS ground test unit to obtain maximum deflection upwards on GLIDE pointer (200 micro= amperes deviation).

(g) Press Captain or First officer PULL-UP warning light :
- excessive deviation under GLIDE beam mode (mode 5) is inhibited and GLIDE SLOPE aural warning does not sound.

(h) Adjust VOR/ILS ground test unit to obtain deflection 1 point upwards on Glide pointer (75 microamperes deviation).

(i) Adjust Plus-Minus potentiometer on radio altimeter ground test unit to obtain 1000 ft on radio altimeter indicator, then decrease altitude to 400 ft.

(j) Adjust VOR/ILS ground test unit to obtain maximum deflection upwards on Glide pointer (deviation 200 microamperes) :

(j1) GLIDE SLOPE aural warning sounds.

(k) On panel 5-211, Captain VOR/ILS/DME control unit :

(k1) Place and hold TEST selector switch in DN/R or UP/L position :
- GLIDE SLOPE aural warning ceases.

(k2) Release TEST selector switch :

- GLIDE SLOPE aural warning sounds after approximately 15 seconds time delay.

(k3) Select a frequency different from ILS frequency :
- GLIDE SLOPE aural warning ceases

(k4) Select ILS frequency on ground test unit :

- GLIDE SLOPE aural warning sounds.

(l) Adjust VOR/ILS ground test unit to obtain deflection 1 point upward on Glide pointer (75 microamperes).

(l1) GLIDE SLOPE aural warning ceases.

(8) Inhibition of GPWS modes by STALL WARNING SIGNAL (Example : with excessive deviation under GLIDE beam, mode 5).

(a) Adjust VOR/ILS ground test unit to obtain maximum deflection upwards on Glide pointer (200 microamperes deviation).

(a1) GLIDE SLOPE aural warning operates.

(b) Make certain on panel 3-213 that circuit breaker RH U/C WEIGHT SW "B" SYS SUP, G294, Map Ref. B9 is set.

(c) On centre console 9-211, ADC control panel :
- Make certain that ADC1 ON-OFF switch is in ON position.
- Place ADC1 test selector switch in 1 position, after some seconds blue TEST indicator light comes on
- Press and release amber ADC1 warning light.

(d) On Captain instrument panel, the instruments indicate values prescribed by test 1, in particular angle of attack indicator displays alpha = $21.5 \pm 0.5°$:

(d1) Stick shaker operates and its associated aural warning horn sounds.

(d2) GLIDE SLOPE aural warning ceases.

(e) On centre console 9-211, ADC control panel, place ADC1 test selector switch in NORM position, the instruments return to their values before test, but check in particular on angle of attack indicator :

(e1) That when alpha = 18 ° :

- Stick shaker no longer operates and its warning ceases
- GLIDE SCOPE aural warning sounds.

(f) Adjust VOR/ILS ground test unit to position glide pointer at centre of scale (0 microamperes deviation).

(f1) GLIDE SLOPE aural warning ceases.

D. Close-Up

(1) On centre console 9-211, ADC control panel place ADC1 ON-OFF switch in OFF position.

(2) Adjust Plus-Minus potentiometer on radio altimeter ground test unit so as to read 0 ft. on Captain radio altimeter indicator.

(3) On panel 2-211, on radio altimeter indicator turn triangle marked knob to counterclockwise stop.

(4) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(5) Switch off electronics rack ventilation system (Ref. 21-21-00).

(6) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

(7) Cut off interphone - ground service jacks connection in flight compartment and disconnect ground service telephone from ground service jack.

(8) Disconnect boomset if necessary :

(a) On panel 20-215, 2nd Supernumerary jack panel.

(b) On LH side console 1-211, Captain jack panel.

(9) Switch off and remove VOR/ILS ground test unit from flight compartment (Ref. 34-36-00, Adjustment/Test).

(10) On LH electronics rack 215 :

(a) Disconnect pressure sensor simulator from ADC1.

(b) Install panel 215BS.

(11) Disconnect and remove radio altimeter ground test unit (Ref. 34-42-00, Adjustment/Test).

3. System Test

Repeat operations in functional test, paragraph 2.

FLASHER UNIT - REMOVAL/INSTALLATION

R 1. General

R The flasher unit is a transistorized unit contained in a rec-
R tangular case with a terminal block on the top panel.
R B The device controls flashing of the PULL-UP warning lights on
R the instrument panels. Two flasher units, W634 and W635 are
R installed in the aircraft, in the LH side console 1-211.
R The two units are identically installed and only one removal/
R installation procedure will be described.

2. Flasher Unit

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
GRD PROXIMITY WARN AC SUP	13-215	W631	G 4
GRD PROXIMITY WARN AC SUP	15-215	W632	G 7

(2) On LH side console 1-211, remove panel 211GS.

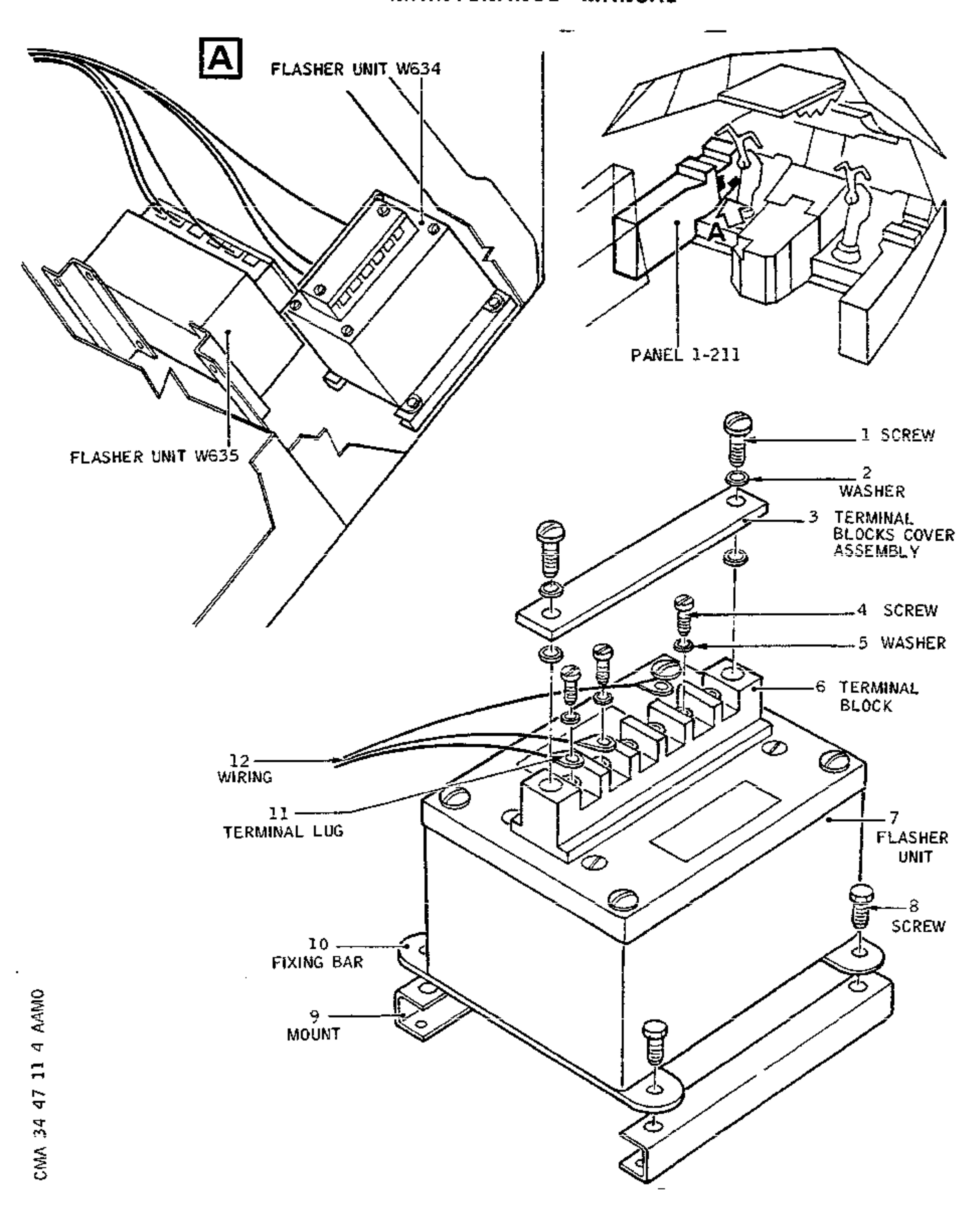
C. Remove (Ref. Fig. 401)

(1) Loosen and remove two screws (1) with washers (2).

(2) Remove terminal block cover assembly (3) from terminal block (6).

(3) Loosen and remove screws (4) and washers (5) attaching terminal lugs (11) to terminal block (6).

(4) Remove wiring (12) from terminal block.



Removal/Installation of GPWS Flasher Units
Figure 401

(5) Loosen and remove the four flasher unit (7) mounting screws (8) from mount (9).

(6) Remove flasher unit (7).

D. Preparation of Replacement Component

(1) Make certain that flasher unit housing is clean, that wiring is in correct condition and that the terminal lugs have no sign of corrosion.

(2) On flasher unit :
- Visually check that unit is in correct condition.
- Loosen and remove two screws (1) and washers (2) from terminal block (6) cover assembly (3).
- Make certain that terminal lugs have no sign of corrosion.

E. Install (Ref. Fig. 401)

(1) Position flasher unit (7) on mount (9).

(2) Install and tighten four screws (8) in fixing bars (10).

(3) Loosen and remove screws (4) and washers (5).

(4) Position terminal lugs (11) on terminal block (6).

(5) On terminal lugs (11), place washers (5) and screws (4), tighten screws.

(6) Position cover assembly (3) on terminal block (6).

(7) On terminal block cover assembly (3), place washers (2) and two screws (1), tighten screws.

F. Test

(1) Remove safety clips and tags and reset the circuit breakers previously tripped in paragraph 2. B. (1).

(2) Carry out operations 1. B, 1. C. (2) and 1. D. from Operational Test, 34-47-00, Adjustment/Test.

G. Close-Up

(1) On LH side console 1-211, install panel 211GS.

GROUND PROXIMITY WARNING COMPUTER - REMOVAL/INSTALLATION

1. General

The ground proximity warning computer (W633) is installed in the LH electronics rack on shelf 6-215.

2. Removal/Installation

A. Equipment and Materials.

DESCRIPTION	PART NO.
Circuit breaker Safety Clips	
Blanking Caps for Electrical Connectors	
Blanking Panel for Ventilation Opening	

B. Prepare

(1) On centre console 9-211, make certain on ADC control panel that ADC ON-OFF switches are in OFF position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH UC WEIGHT SW "A" & DOWNLOCK SYS SUP	1-213	G 295	M18
AUDIO WARN SYS SUP 1		W 371	M21
ADC1 28V SUP		1F 74	P12
ADC1 26V SUP	2-213	1F 78	A 2
1ST PLT VSI SUP		1F 97	A 3
1ST PLT ADC INST SUP		1F 75	B 3
RAD ALT 1 SUP		1S 56	D 8
ADC1 115V SUP		1F 73	F 3
FLT CONT & NAV BUS 14XS		X 355	H 2
AUDIO WARN SYS SUP 2	5-213	W 372	C17
GRD PROXIMITY WARN AC SUP	13-215	W 631	G 4
RAD ALT 1 & 2 IND	15-215	S 57	C 5
LIGHT TEST		L1001	E14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
GRD PROXIMITY WARN DC SUP		W 632	G 7
NAV INST BUS 13XS	13-216	X 345	G 4

(3) On LH electronics rack remove panel 215BS to gain access to shelf 6-215.

C. Remove (Ref. Fig. 401)

(1) Loosen locking nut (5) until locking stud (9) on computer (7) is freed.

(2) Lower locking nut threaded mounting rod.

(3) Lift computer handle (8) and pull slowly out to release rear connector (6) from rack connector (2). Continue withdrawal forwards until computer is completely released from slides, remove computer.

(4) Cap connectors (6) and (2).

(5) Install blanking panel on ventilation opening (3) left free in rack.

D. Preparation of Replacement Component.

(1) Make certain that rack is clean and aircraft connector is in correct condition (pins undamaged and with no trace of oxydation).

(2) Make certain that computer is in good external condition that its connector is undamaged and the pins have no trace of oxydation.

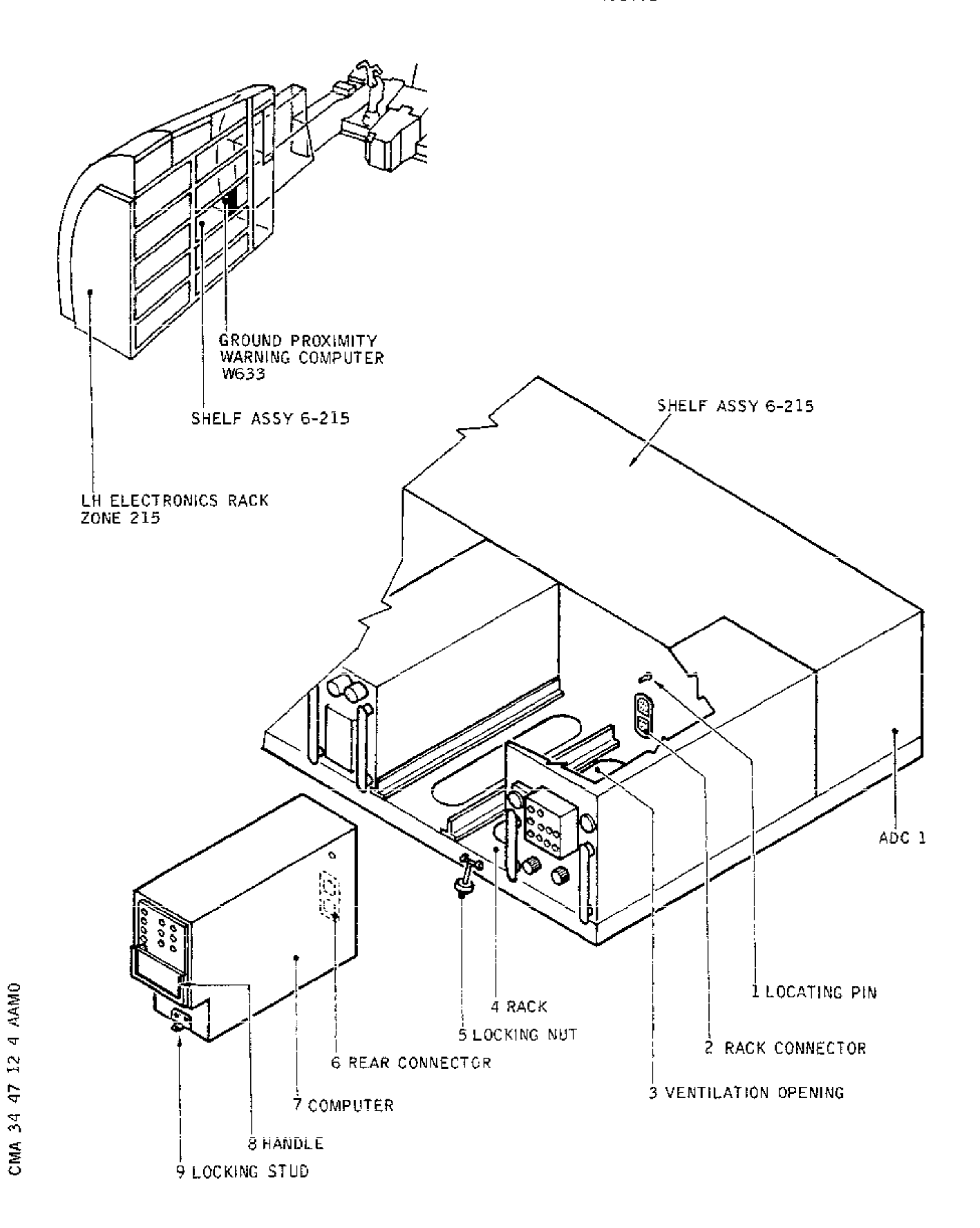
E. Install (Ref. Fig. 401)

(1) Remove blanking panel from ventilation opening (3) in rack.

(2) Remove blanking caps from connectors (2) and (6).

(3) Position computer (7) on rack (4), slowly slide in, making certain that locating pin (1) is engaged.

(4) Continue to slide in computer, carefully engaging



Removal/Installation of Ground Proximity Warning Computer
Figure 401

male and female connector until pushed fully home.

(5) Raise locking nut threaded mounting rod (9), engaging locking nut with locking stud (5), tighten nut until locked.

(6) Lower computer handle (8).

F. Close-Up

(1) Perform ground proximity warning computer test (Ref. 34-47-12, Adjustment/Test).

(2) On LH electronics rack, install panel 215BS.

GROUND PROXIMITY WARNING COMPUTER - ADJUSTMENT/TEST

1. General

The purpose of this adjustment/test is to check correct operation of the ground proximity warning computer, after removal/installation or replacement.
The test is activated by means of SELF-TEST push-button on the front panel of the computer.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) With aircraft on ground or on jacks with main landing gear downlocked.

(2) Place droop nose in 0° position (Ref. 27-61-00, Adjustment/Test).

(3) Remove safety clips and tags and reset the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH UC WEIGHT SW "A" & DOWNLOCK SYS SUP	1-213	G 295	M18
AUDIO WARN SYS SUP 1		W 371	M21
ADC1 28V SUP		1F 74	P12
ADC1 26V SUP	2-213	1F 78	A 2
1ST PLT VSI SUP		1F 97	A 3
1ST PLT ADC INST SUP		1F 75	B 3
RAD ALT1 SUP		1S 56	D 8
ADC1 115V SUP		1F 73	F 3
FLT CONT & NAV BUS 14XS		X 355	H 2
AUDIO WARN SYS SUP 2	5-213	W 372	C17
GRD PROXIMITY WARN AC SUP	13-215	W 631	G 4

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RAD ALT 1 & 2 IND	15-215	S 57	C 5
LIGHT TEST		L1001	E14
GRD PROXIMITY WARN DC SUP		W 632	G 7
NAV INST BUS 13XJ	13-216	X 345	G 4

(4) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(5) Switch on electronics rack ventilation system (Ref. 21-21-00).

(6) On centre console 9-211, ADC control panel :

(a) Make certain that test selector switches are in NORM position.

(b) Place ADC1 ON-OFF switch in ON position, after 30 seconds press and release amber ADC1 warning light.

C. Tests

(1) On LH electronics rack, shelf 6-215, on ground proximity warning computer :

(a) Make certain that WARNING MODE magnetic indicators are black. If one of the indicators is white, press the WARNING MODE RESET push-button.

(b) Press and hold SELF-TEST push-button :

(b1) The five red warning lights RADIO ALT, FLAP DN, GEAR, AIR DATA and G/S VAL and green GPWC OK indicator light come on and go off if the test operates correctly. GPWC OK green indicator light again comes on.

(b2) WARNING MODE magnetic indicators change to white.

R B (b3) On Captain and F/O instrument panels,
R PUL-UP warning lights flash.

(b4) Aural warning sounds in audio warning system

londspeakers (glide slope once and PULL UP several times).

(c) Release SELF TEST push-button :

(c1) Green GPWC OK indicator light goes off.

(c2) Aural warning ceases.

R B (c3) On Captain and F/O instrument panels,
R PULL-UP warning lights go off.

(d) Press RESET push-button :

(d1) WARNING MODE magnetic indicators change to black.

D. Close-Up

(1) On centre console 9-211, place ADC1 ON-OFF switch in OFF position.

(2) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

DEPENDENT POSITION DETERMINING - DESCRIPTION AND OPERATION

1. General

Dependent position determining is the part of the system which mainly depends on the ground installations, which supply information of aircraft position. It includes the ADF, VOR, DME, ATC and TCAS.

2. VOR System

The Visual Omni Range (VOR) system continuously supplies the position of the selected VOR station (magnetic bearing of the station relative to aircraft heading). The system operates in the VHF band. The receiver analyses two types of signal, omni directional and directional, transmitted by the ground VOR station. Station identification is made by a morse code identification signal on the aural channel. The processing of the received signals in two separate channels enables the VOR bearing information to be passed to the RMI indicator. In case of a malfunction the warning indication appears. On the combined VOR/NAV indicator, RIGHT-LEFT information is displayed with respect to the manually set VOR course, as well as TO-FROM information. The FLAG ALARM flags appear in case of a malfunction.

The VOR system comprises an antenna, a receiver, a common VOR/DME/ILS control box and an RMI indicator.
The frequency band used is from 108 to 117.95 MHz.

3. ADF System

The Automatic Direction Finding (ADF) system is a navigational aid working in the 190-1799.5 kHz band. In ADF operation (automatic direction finding), the receiver automatically supplies the bearing of the station to the RMI indicators. The simultaneous identification signal of the station from which bearing information is being received allows a continuous check of tuning and station identification. In LOOP operation the system is in manual direction finding mode. The bearing of the station is taken by the null finding method. In ANT (antenna) operation, the receiver operates as a normal traffic receiver using only the omni directional antenna. The ADF assembly consists of a receiver, a controller, a sense antenna, an antenna coupler, a sense cable equalizer, a loop antenna, a quadrantal error corrector and an RMI indicator.

4. ATC System

For Air Traffic Control (ATC) system Mode S ATC1 and ATC2 refer to 34-52-00.

5. DME System

The Distance Measuring Equipment (DME) system enables display on a double-indicator of the distance between the aircraft and a ground DME beacon identified by its call sign. The maximum range is 300 Nm, to a precision of ± 0.3 Nm.

The transmitter-receiver assembly electronically measures as a distance the time delay between transmission of a signal from the aircraft to the beacon and the reception of the response. The measured distance is oblique (beacon-aircraft). The system can be operated on 252 channels, spaced at 1 kHz intervals. The channels are selected on the control panel.
The system consists of a transmitter-receiver, a common VOR/DME/ILS control panel, a double DME indicator and an antenna.

6. TCAS System

For Traffic Collision Avoidance System (TCAS) refer to 34-43-00.

DISTANCE MEASURING EQUIPMENT (DME) - DESCRIPTION AND OPERATION

1. General

This equipment is used to permanently display the distance between the aircraft on which it is installed and a VOR station on the ground.
When the desired VOR frequency has been set on the VOR/ILS/DME control unit, the DME system operates automatically and needs no adjustment.
Setting a VOR frequency determines the corresponding DME channel among the 252 available channels of the system, which are classed as 126 mode X channels and 126 mode Y channels. The basic function of the DME system is measurement of time taken for an interrogation pulse to reach a ground station and return to the aircraft interrogator. This time measurement is displayed to the crew after conversion as a direct distance measurement expressed in nautical miles on the dual DME distance indicators located on Captain and First Officer instrument panels. Reception of a morse signal transmitted by the ground station allows the station to be identified.
The DME can measure from 0 to 390 nautical miles.
B DME data is also used to update the INS (34-45-00)

2. System Components

The DME system is made up of

- two DME interrogators (1S1 and 2S1)
- two dual DME indicators (1S7 and 2S7)
- two VOR/ILS/DME control units (1R28 and 2R28)
- two DME antennas (1S2 and 2S2).

R **ON A/C 001-005,
3. Interrogator - DME, Collins 860E-3

A. Description (Ref. Fig. 001)

The DME interrogator is contained in a rectangular half ATR short case and weighs 9.2 Kg (20.3 lb).

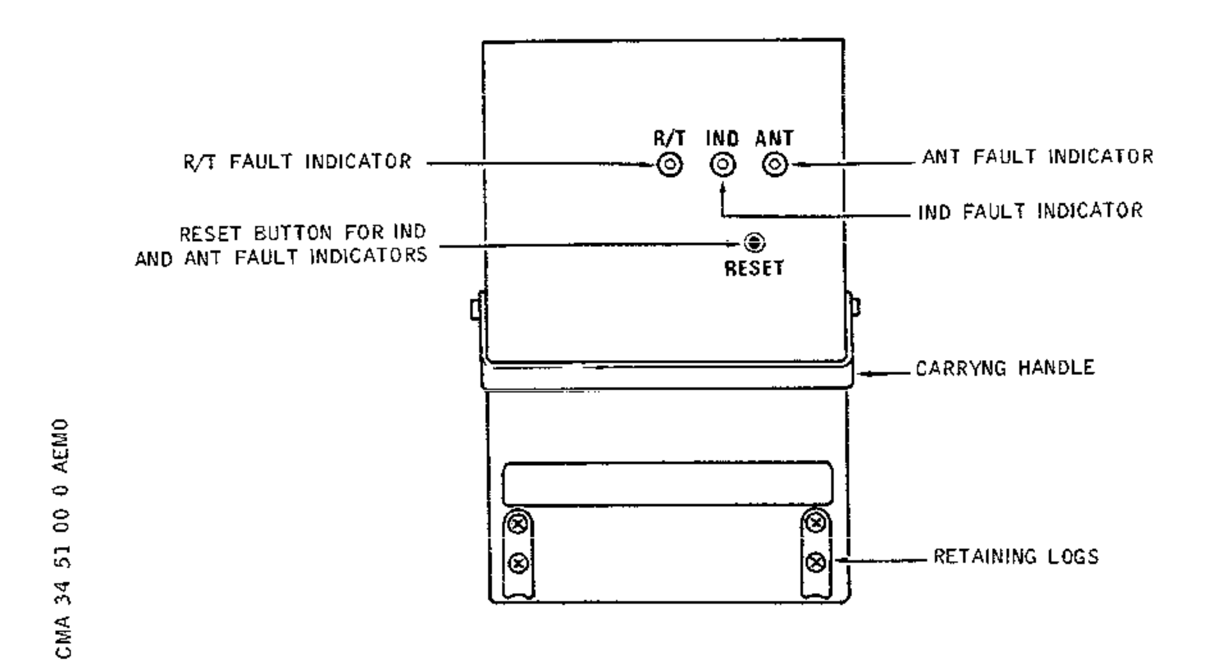
(1) Physical characteristics

(a) On the front panel are mounted

- a carrying handle

- two retaining lugs for installing the interrogator on its rack

R **ON A/C 001-005,



DME Interrogator - View of Front Panel
Figure 001

- an R/T fault indicator, which indicates faults in the interrogator (yellow indicates a fault, black indicates correct operation)
- an IND fault indicator, which indicates faults in the dual DME indicator yellow indicates a fault, black indicates correct operation)
- an ANT fault indicator, which indicates faults in the antenna or in the antenna circuit (yellow indicates a fault, black indicates correct operation)
- a RESET button which switches the IND or ANT fault indicator back to normal operation (black colour).

(b) On the rear panel are mounted

- an electrical connector for connections between the interrogator and the aircraft electrical network

- two coaxial connectors : one for the antenna and the other for the suppressor signal.

(2) Electrical characteristics

The DME interrogator makes maximum use of semi-conductors, except for the transmitter modulator sub-assembly which makes use of electron tubes.

(a) Transmission

- Frequency range : 1025 to 1150 MHz
- Output power : At least 1KW
- Output impedance : 52 ohms.

(b) Reception

- Frequency range : 962 to 1213 MHz
- Sensitivity : - 93 dbm minimum
- Audio output : 75 mW into 200 to 500 ohm load.

(c) Power

- Power supply : 115VAC
- Comsumption : 80 Watts

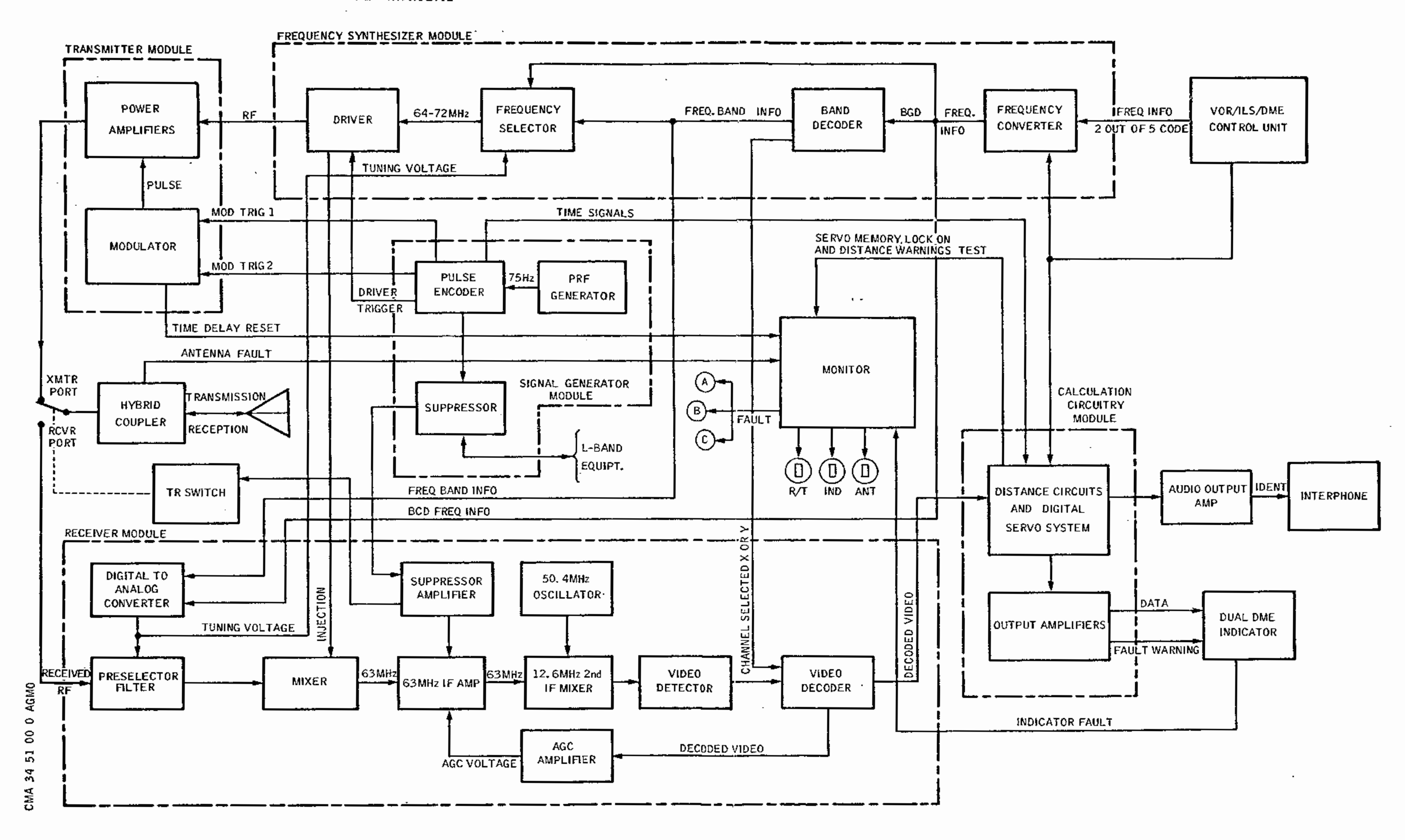
B. Operation (Ref. Fig. 002)

The DME interrogator can be sub-divided into seven principal sections.
- Signal generator module
- Frequency synthesizer module
- Transmitter module
- Receiver module
- Calculation circuitry
- Monitoring and test circuitry
- Suppressor circuit.

(1) Signal generator

To carry out distance measurement by a time measurement method the different calculation circuits must be tripped for precisely determined periods by a frequency pulse generation stage.
A generator sends the 75 Hz pulse repetition frequency (PRF) to the pulse encoder which generates different

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DME Interrogator - Operation Schematic
Figure 002

time pulses for
- the distance circuit and digital servo system stages
- the driver stage of the frequency synthesizer module
- the transmitter modulator stage
- the suppressor circuit.

(2) Frequency synthesizer module

When a frequency is selected at the VOR/ILS/DME control unit a binary coded two-out-of-five output is sent to the frequency converter stage. The amplified two-out-of-five signals are converted into binary coded decimal (BCD) frequency information, which is applied to
- the frequency selector stage
- the converter stage of the receiver module
- the band decoder stage.

BCD information is decoded in the band decoder to indicate
- in which of the four frequency bands the selected frequency is located
- the channel in use (X or Y)

These decoded signals are applied as follows :
- the FREQ BAND INFO goes to the frequency selector stage and to the digital to analog convertor of the receiver module
- the CHANNEL SELECTED X or Y signal goes to the video decoder stage of the receiver module.

The frequency selector stage generates a 64 to 75 MHz frequency signal, depending on the frequency selected at the control unit.
The driver stage receives both the selected signal from the frequency selector and the tuning voltage from the receiver module. After filtering, multiplication and amplification the repetition frequency (RF) signal is developed and applied to the transmitter module on presence of the DRIVER TRIGGER signal from the signal generator module.
An INJECTION signal generated in the driver stage is applied to the receiver module to produce the first intermediate frequency (IF).

(3) Transmitter module

The RF signal generated by the frequency synthesizer module is applied to the power amplifiers which, when triggered by a modulation pulse, generate high power interrogation pulses.
The signal generator, module sends low level MOD.TRIG. 1 and MOD.TRIG 2 trigger pulses to the modulator stage which, after transformation, applies a high level

modulation pulse to the power amplifiers. When the RF signal and the modulation pulse arrive simultaneously at the power amplifier stage, interrogation pulses are generated and sent to the antenna through the transmitted port of the duplexer (3db hybrid coupler) in transmit position.

(4) Receiver module

When interrogation pulse transmission is completed the antenna is switched to the receiver port of the duplexer (3 db hybrid coupler).
The digital to analog converter stage receives the FREQ.BAND INFO and BCD FREQ.INFO signals from the frequency synthesizer module and converts them into an analog signal tuned to the frequency selected at the control unit.
The received RF signal (return pulse pair) is applied to the preselector filter stage which is tuned by the tuning voltage from the digital to analog converter.
The received RF signal is thus filtered and applied to the mixer, which also receives the (transmission frequency) injection signal from the frequency synthesizer module. The first intermediate frequency signal is then generated at the output of the mixer (IF = 63 MHz).
The first IF is transmitted to an IF amplifier controlled by automatic gain control (AGC) voltage.
The IF amplifier output is applied to a mixer which is directed by a 50.4 MHz oscillator so as to obtain a second IF of 12.6 MHz, allowing video pulse pairs to be generated. Each video pulse pair generated is made up of noise, squitter and received replies.
The video pulses are applied to the video detector, then to the video decoder which checks the input pulses for uniform spacing and amplitude. These stages produce a single output pulse (1 microsecond) from each input pulse pair. This output pulse is sent to the calculation circuitry.

(5) Calculation circuitry

(a) Calculation

The distance calculation circuits measure the time between transmission of an interrogation pulse pair and reception of a corresponding reply pulse pair. This time measurement is then converted into a distance signal.
During each interrogation period the calculation circuits develop a range gate pulse which is

used to search for decoded video pulses.
Two clocks and two counters are used. One counter counts 8.09 MHz clock pulses to develop distance data in 0.01 nautical mile (NM) increments. When the number in this counter reaches 0.09, and then charges to 0.00, an overflow pulse is applied to a second counter (0.01 NM increments, controlled by a 8.09 MHz clock). The second counter develops distance data in 0.1 NMI increments over the range -1.0 to 389.9 NMI. This data is applied both to the register and to the range gate generator. When a reply is located the range gate stops searching as the decoded video pulses are synchronized with the interrogation pulses.
When the video pulse is centered in the range gate this signal is applied to the digital servo system stage which is used to retain this coincidence in spite of variations in aircraft speed (increase or decrease) and distance from the ground station. The signal, when held at coincidence, is shifted to a register, then sent to output amplifiers. The amplified distance measurement signal is sent to the dual DME distance indicator. An audio stage detects the ground station identification signal, which is part of the reply signal. After amplification this audio signal is sent to the interphone signal for identification of the ground station.

(b) Utilization

(b1) Time delay

This delay begins when the system is started up and lasts 58 seconds. During this delay transmission is inhibited and the receiver module operates.
During this time these is no interrogation and the information applied to the distance indicator causes four dashes to be displayed.

(b2) Automatic standby

The receiver counts the number of received pulse pairs. If this number is greater than 600 per second and the time delay is over the transmitter is excited and the search mode begins.
If this number is less than 600 the receiver stays in automatic standby until more than 600 pulses per second are received.

(b3) Search

This mode begins if
- automatic standby is finished,
- the channel is changed, or
- the reply signal being tracked is lost.
If after a length of time called memory the receiver has not relocated the reply signal, the system goes into search.
When the system has identified a decoded pulse it waits until the next interrogation pulse pair is transmitted. It then counts until the last reply pulse is received and then develops a range gate pulse. Presence of a decoded pulse in the range gate means that twice in a row the receiver has found a pulse located at the same time interval after the second interrogation pulse. The necessary criterion for changing to pretrack mode is location of seven decoded pulses during fifteen consecutive interrogation periods.
If the receiver does not locate a pulse for three consecutive interrogation periods during search, operation is as follows :
During the third interrogation period the interrogator develops a range gate pulse and scans through the whole distance range (- 1.4 to 390 NM) until it locates a decoded reply. The system then moves the range gate to this point in time.
As soon as two consecutive reply pulses are located, the interrogator immobilizes the range gate until seven decoded pulses are received during fifteen consecutive interrogation periods. The interrogator then operates in pretrack mode.
During the search phase the interrogation rate is 75 pulse pairs per second. The interrogator sends information to the distance indicator which causes it to display four dashes.

(b4) Pretrack

Pretrack is a 2.6 second interval between search and track modes of operation. In this mode the interrogation rate is 75 pulse pairs per second, and the distance indicator displays distance.

(b5) Track

In this mode the interrogator maintains the alignment between the range gate and the decoded reply. As the aircraft moves closer or further away from the ground station, replies are received sooner or later, so to avoid errors or loss of the reply signal
R the range gate has to be moved. This is done by shifting the range gate by 0.01 NM (0.1236 microsecond) increments.
To maintain track the receiver must locate at least seven decoded reply pulse pairs during fifteen interrogation periods. If this condition is not met the interrogator changes to memory mode.
In track mode the distance indicator displays the distance to the ground station and the interrogation rate is a quarter the rate of search mode.

(b6) Memory

This mode is characterized by a temporary or permanent loss of the reply signal. If the signal is lost for a time greater than the memory period (which can be adjusted in workshop) the system returns to search mode. If the signal is reacquired during memory the interrogator returns to track mode.
In this mode the interrogation rate is identical to that of track mode and the distance indicator continues to display distance to the station.

(b7) Manual standby

When the system is switched to S/B on the control unit the transmitter is inhibited and only the receiver operates.
The distance indicator displays four dashes and, if a ground station is received, its identifier is audible.

(6) Monitoring and test circuitry

(a) Monitoring

The MONITOR module monitors possible faults in the interrogator circuits. Three binary code

fault indicators (A, B, C) located on this module allow isolation of the defective circuit or circuits monitored. These indicators, in conjunction with the R/T fault indicator on the front panel of the interrogator provide status information for the eight functional circuits monitored. The MONITOR module also contains amplifiers which energize the fault indicators (R/T, IND and ANT) on the front panel of the interrogator.
These three indicators are magnetically held. Once they have been tripped they must be reset to cancel fault warnings. These indicators therefore allow the faulty component (distance indicator, interrogator or antenna) to be identified.
The monitor module also generates a FLAG ALARM failure warning signal which is sent
- to the distance indicator to cancel the distance display
- to the front panel of the interrogator, where it trips the R/T and IND fault indicators.

A distance indicator fault only trips the IND fault indicator on the front panel.
An antenna fault only trips the ANT fault indicator on the front panel.
A RESET button, on the front panel resets the IND and ANT fault indicators in the case of a transitory fault or a fault caused by the interrogator.

(b) Automatic self-test

When the interrogator is in search or automatic standby mode, it automatically self-tests every 58 seconds. Satisfactory self-test results are indicated by a continuous display of four dashes on the distance indicator. If a fault is found during self-test, the FLAG ALARM signal is applied to the distance indicator.

(c) Manual self-test

When the TEST pin of the connector on the rear panel of the interrogator is connected to ground a test sequence is set off in the distance circuits and digital servo system stages. One stage generates a simulated reply pulse representing a distance of 0 NM which is applied to the other stages of the calculation circuitry.
If all the circuits operate correctly the resulting signal applied to the distance indicator causes a display of 000.0 or 000.1 NM. During

self-test the distance indicator displays the following sequence :
- warning (blank display) for one second followed by four dashes for one second, in turn followed by a distance of 000.0 (± 0.1) NM.

(7) Suppressor circuit

(a) When a transmission phase is initiated a SUPPRESSOR signal is applied to a suppression port which sends this signal :

(a1) out of the interrogator to disable other systems operating in the same frequency band, so as to avoid any interference which could cause errors.

(a2) to the suppressor amplifier of the receiver module, causing
- disabling of the 63 MHz IF amplifier
- non-application of tuning voltage information to the preselector filter.

(a3) to the antenna connection on the transmitter port of the duplexer.

(b) When another system operating in the same frequency band is transmitting a suppressor signal is applied to the suppression port which directs this information to the duplexer and to the suppressor amplifier (Ref. paragraph (7) (a) (a2) and (a3) above).

R **ON A/C 006-007,
R 3. Interrogator - DME, Collins 860E-5

R A. Description

R The DME interrogator is contained in a rectangular half ATR
R short case and weighs 7.300 Kg (16 lb).

R (1) Physical characteristics

R (a) On the front panel are mounted

R - a carrying handle

R - two retaining lugs for installing the interro-
R gator on its rack
R (b) On the rear panel is mounted an electrical

connector with two functions :
- one provides the connection between the interrogator and the aircraft electrical network
- the other comprises the connector pins for the antenna, suppression and video receiver outputs.

(2) Electrical characteristics

(a) Power supply : 115VAC ± 10%
Consumption : 80 Watts

(b) Transmission

- Frequency range	: 1025 to 115 0 MHz
- Output power	: 700 W
- Interrogation time	: 90 pp/s in search and pre-track mode 22.5 pp/s in track mode and memory
- Inter-pulse spacing	: 12 µ ± 0.5 for X channel 36 µ ± 0.5 for Y channel

(c) Reception

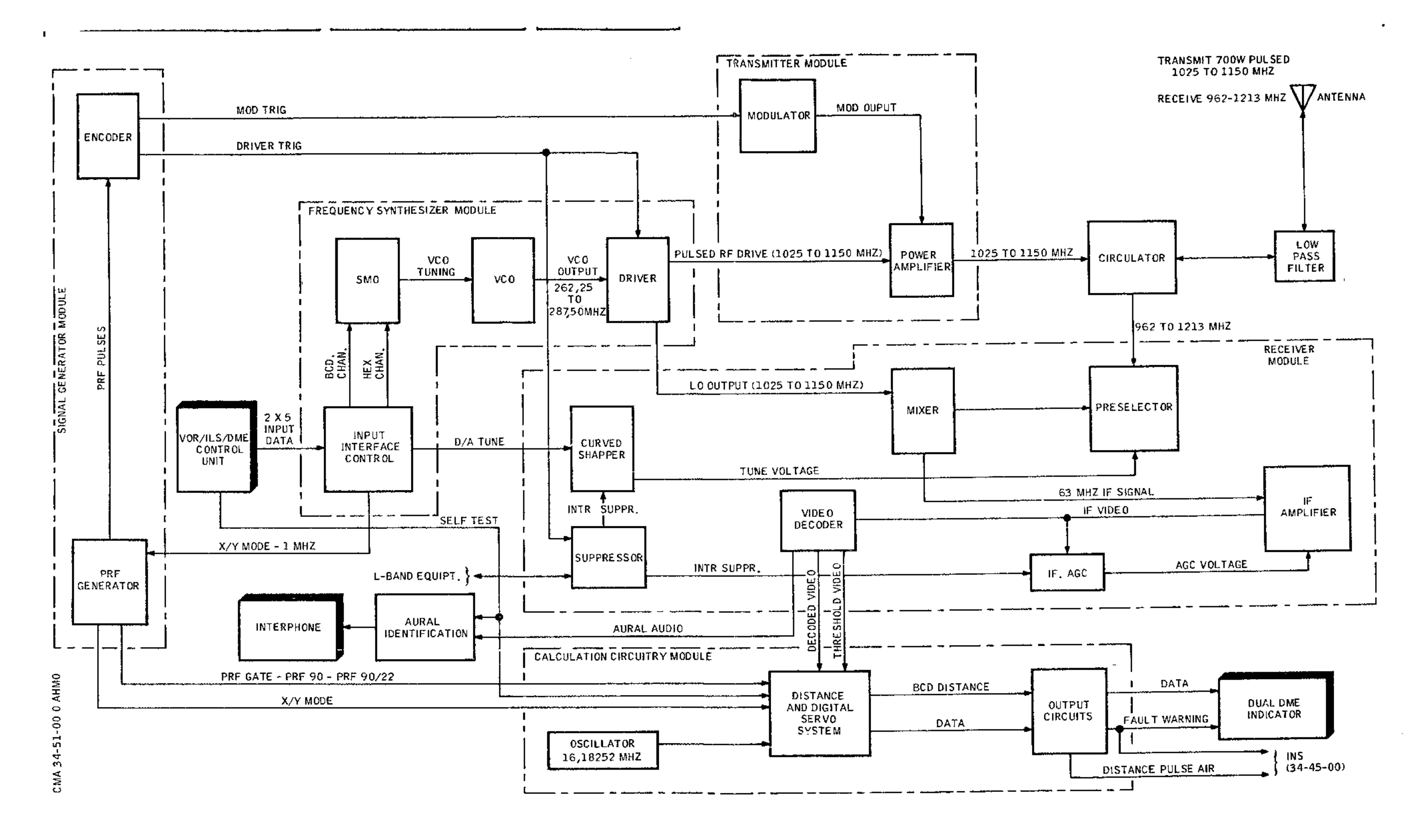
- Frequency range	: 962 to 1213 MHz
- Sensitivity	: - 90 dbm
- Audio output	: 75 mW at 200-500 ohm load

B. Operation (Ref. Fig. 003)

The DME interrogator can be sub-divided into seven principal sections.
- Signal generator module
- Frequency synthesizer module
- Transmitter module
- Receiver module
= Calculation circuitry
- Suppressor circuit.

(1) Signal generator module

To carry out distance measurement it is necessary to provide trigger signals at various stages for precisely determined periods
A pulse repetition frequency generator (PRF generator) generates pulses which are applied to :
- calculation circuitry module



R DME Interrogator - Functional Schematic
Figure 003

R - coder stage of the encoder
R The coder stage generates the following time pulses :
R - MOD TRIG, which is sent to the modulator stage of the transmitter module
R - DRIVER TRIG, which is sent to the driver stage of the frequency synthesizer module and to the suppressor stage of the suppressor circuit.

R (2) Frequency synthesizer module

R The selected frequency displayed on the VOR/ILS/DME control unit determines a coded binary two-out-of-five information which is applied to the input interface CONTROL stage, which converts the signals representing the selected DME channel into :
- coded numbers (BCD and HEX CHAN.) sent to the SMO stage
- a D/A TUNE matched analog voltage sent to the curved shaper stage of reception module
- A signal (X/Y mode) representing the channel utilized (X or Y) sent to the PRF generator stage of the signal generator module.

The BCD signals applied to SMO stage stabilized master oscillation produce a matched voltage at the VCO (Voltage Controlled Oscillator) stage which generates an HF output signal in the band 256.25 to 287.5 MHz. This HF signal is then applied to the driver stage, where its frequency is multiplied by 4 in order to obtain the L band signal (1025 to 1150 MHz) which is developed on presence of the signal generator module DRIVER TRIG signal. The driver stage delivers two signals :
- a pulsed RF drive signal applied to transmitter module power amplifier stage
- a LO output signal applied to receiver module mixer stage.

R (3) Transmitter module

R The MOD TRIG pulse from the signal generator module is applied to the modulator stage, which produces a high voltage (Mod Output) at the power amplifier stage. The latter also receives the pulsed RF drive signal from the frequency synthesizer module driver stage. The simultaneous presence of these two signals at the power amplifier stage generates 700 W interrogation pulses which are applied to the circulator which isolates the receiver path from the transmitter path. The RF transmitter 1025 to 1150 MHz signal from the circulator transmitter channel output is directed to the antenna via a low pass filter, which reduces

spurious transmission of harmonic frequencies.

(4) Receiver module

When the transmission of interrogation pulses is terminated, the circulator is in reception position, isolating the transmitter path input.
The 962 to 1213 MHz frequency band RF reception signal received from the ground station is sent via the low pass filter and circulator to the preselector stage, which is tuned by the tuning voltage from the curved shaper stage.
The tuned RF reception signal is applied to the mixer stage which receives the LO OUTPUT injection signal from the frequency synthesizer module driver stage.
After mixing a 63 MHz intermediate frequency (IF) signal is applied to IF amplifier stage, where it is mixed, amplified and then applied to a detector which converts it to an IF video signal; the IF amplifier stage is AGC (automatic gain control) controlled.
The IF video signal obtained is directed to the video decoder stage, which searches the input pulses for proper spacing i.e. 12 µs for X channels and 30 µs for Y channels. When pulse spacing and amplification are correct, two single-pulse output signals are distributed to the calculation circuitry (the threshold video pulse coincides with the first pulse of the pulse pair; the decoded video signal coincides with the second pulse of the pulse pair).
If a 1350 Hz identification signal is detected in the video signal, it is applied to the aural identification stage which amplifies it and directs it to the interphone system to obtain DME ground station identification.

(5) Calculation Circuitry Module

(a) Calculation

The distance calculation circuits measure the time between transmission of a pair of interrogation pulses and the reception of a pair of corresponding pulses. The measurement of this time is converted into a distance signal. During each interrogation period the calculation circuits develop a range gate pulse which is used to search for decoded video pulses. When a reply is located the range gate stops searching as the decoded video pulses are synchronized with the interrogation pulses. When the video pulse is centred in the range gate, the signal is

R applied to the digital servo system stage, which is used to conserve the range gate coincidence, irrespective of :
- an increase or decrease in aircraft speed
- increased or decreased distance from the ground station.

The coincidence signal being held, is applied to the output circuits stage, which transmits the calculated distance to the indicators and aircraft systems.

R (b) Modes of operation

R (b1) Manual standby mode

R With the aircraft on the ground, the control unit switch is placed in S/B position. This inhibits transmission and the receiver module is operative. The dual DME indicator displays 4 dashes and the ground station identification code is audible.

R (b2) Automatic standby mode

R With the aircraft in flight and the control unit switch placed in ON position, the DME starts in signal controlled search (SCS). In this mode the transmitter is inhibited and the receiver operative. When the receiver is receiving more than 450 pulse pairs per second from the ground station, the DME switches to the search mode.

R (b3) Search mode

R This mode begins when :
- automatic standby is finished,
- the channel is changed, or
- the reply signal being tracked is lost.

As soon as the system has located a decoded reply pulse it waits until the next interrogation pulse pair is transmitted. It then counts out the time the last reply pulse was received and develops a range gate pulse The presence of a coded reply pulse in the range gate means that twice in a row the the receiver has found a pulse located at at the same time interval after the second interrogation pulse. The location of seven decoded reply pulses in fifteen consecutive interrogation periods constitutes the

R required criterion for the DME to switch to the pretrack mode.
R If the receiver does not find a reply pulse during three interrogation periods, or if it loses the seven pulses in fifteen periods decision, the following function occurs :

R - the DME interrogator searches progressively from 0 to 390 NM until it finds a coded reply pulse. When a pulse is found the range gate is then developed at the same period and same time. When seven decoded pulses occur during fifteen consecutive search periods, the DME will operate in pretrack mode. The interrogation rate in search mode is 90 pulse pairs per second.

R (b4) Pretrack mode

R In this mode the DME determines the relative speed of the aircraft with respect to the ground station. This is achieved during the 4-second duration of the mode by a velocity accumulator which positions the range gate so that reply pulses are centred within it. During this mode the DME continues to interrogate the ground station at the rate of 90 pulse pairs/second, and the aircraft ground station distance appears on the DME indicator.

R (b5) Track mode

R In this mode the interrogator maintains the alignment between the range gate and the decoded reply pulse. During this mode the interrogation rate is decreased to 22.5 pp/s and the velocity accumulator continues to keep the reply pulses centred in the range gate. To maintain track mode the receiver must locate at least seven consecutive decoded reply pulse pairs for every fifteen interrogation periods. If this criterion is not satisfied the DME changes to memory mode.

R (b6) Memory mode

R This 11.4 second mode is characterized by a temporary or permanent loss of reply signal. The DME continues interrogations at the 22.5 pp/s rate and the distance dis-

played on the indicator is that of track mode. If the signal is reacquired during memory mode the DME returns to track mode, and if the signal is lost it changes to search mode.

(6) Monitoring and test circuitry

(a) Self-Test

When TEST position is selected on this DME control unit, the digital DME indicator shows :
- a flag for 92-second period
- three dashes, and a distance of 000.0 NM for a 3-second period. When the TEST switch is released the distance indication will remain for the 11.4 second memory time.

(b) Monitoring

Portions of the DME are monitored during the various operational modes :

(b1) A transmitter power monitor is operational continuously causing the warning flag to appear each time the power output is below 125 W.

(b2) Two monitors, one for the receiver and the other for the distance reply are operative when :
- the Self-Test is activated
- the interrogator loses lock
- every 60 seconds, when the interrogator is out of range of the ground station. Any one of these three conditions will cause the warning flag to appear.

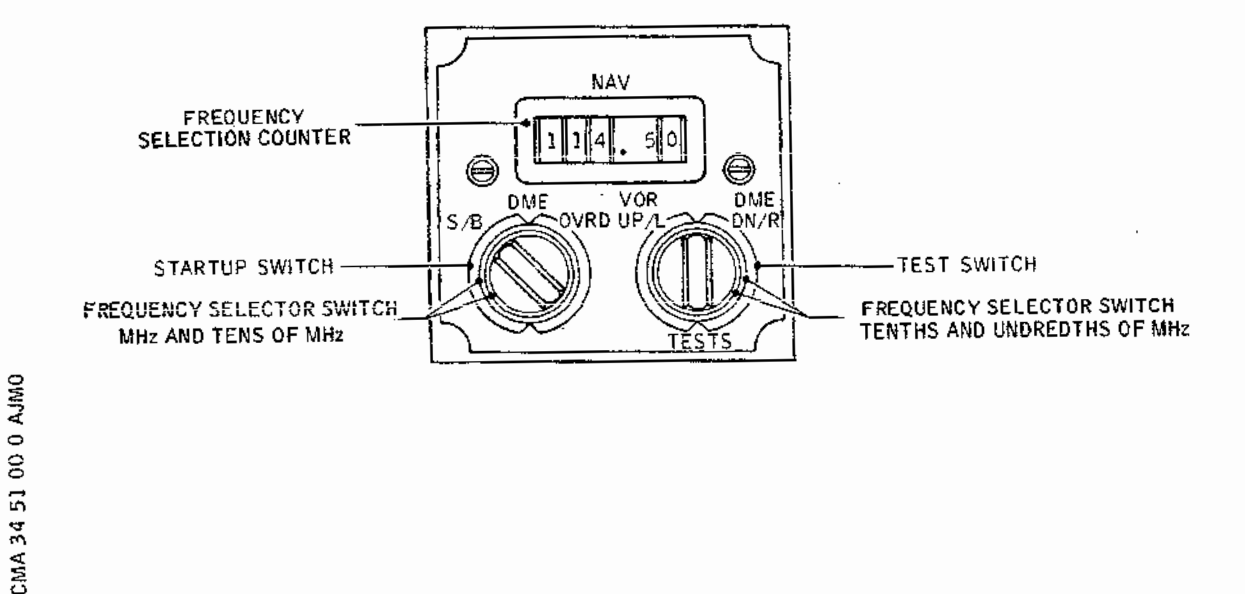
(7) Suppressor circuit

(a) When the DME is operating in transmission phase, a suppressor signal is applied to the suppression stage, which sends this signal :
- to neutralize other systems operating on the same waveband
- to ensure non-application of tuning voltage information to the preselector stage via the curved shaper stage
- to neutralize the IF amplifier stage via the AGC stage.

R (b) When another system is transmitting on the same
R waveband a suppressor signal is applied to the
R suppressor stage, which reacts in the same way as
R described in (7)(a) above.

4. Control Unit - VOR/ILS/DME, EAS-BN1-671D

A. Description (Ref. Fig. 004)



Control Unit - View of Front Panel
Figure 004

The control unit is contained in a rectangular case and is common to the VOR, ILS and DME systems.

(1) On the front panel the following items are mounted.

(a) In the lower LH corner there are two concentric rotary switches

- The outer switch, marked S/B-DME-OVRD is used to control the DME system.
- The inner switch is used for frequency selection, in megahertz and tens of megahertz.

(b) In the lower RH corner there are two concentric rotary switches.

- The outer switch, marked TEST, is used for carrying out VOR, ILS and DME tests (the switch returns automatically to the neutral position).

- The inner switch is used for frequency selection, in tenths and hundredths of megahertz.

(c) In the centre of the front panel there is a display window, which shows the frequency selected.

(2) On the rear panel of the control unit there is a connector for connections between the control unit and the aircraft electrical network and other components of the system.

B. Operation

The VOR, ILS and DME systems are controlled by a two-out-of-five binary code method. When a VOR or ILS frequency (108 to 117.95 MHz) is selected the corresponding DME or TACAN channel, and thus the transmission and reception frequencies, are determined. Control is carried out electrically through a resistance bridge.
The various positions of the outer LH switch are used for the following :

- S/B (Standby) for energizing the interrogator

- DME for interrogator operation with normal sensitivity (0 to 200 NM)

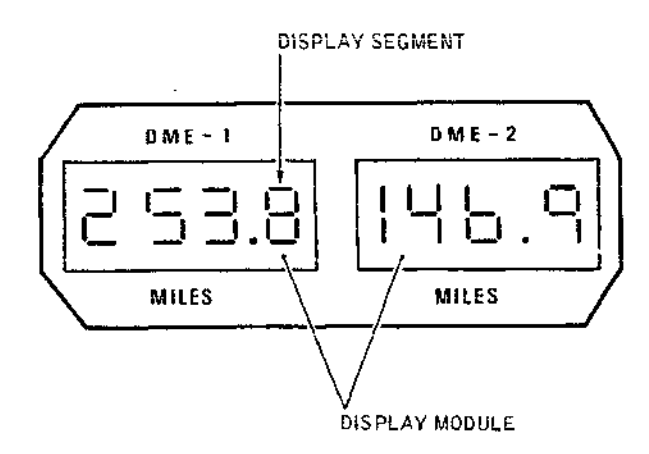
- OVRD for interrogator operation with increased sensitivity (0 to 390 NM).

The outer RH TEST switch, in the DME-DN/R position connects the interrogator test line to ground and sets off the test sequence.

5. Indicator - Dual DME, Clifton

A. Description (Ref. Fig. 005)

The digital dual DME indicator contains two separate identical display modules ; one is supplied by DME interrogator 1, and the other by DME interrogator 2. Each display module consists of four tubes, each with a seven segment incandescent display. Each tube can display numbers from one to



Dual DME Indicator - View of Front Panel
Figure 005

nine and a horizontal bar, or dash. The indicators display hundreds, tens, units and tenths from 000,0 to 399.9 NM.

B. Operation

Each display module receives the following numerical signal on the data transmission line from the interrogator :
- Word synchronization (SYNC)
- Information (DATA)
- Clock signal (CLOCK)

These signals are applied to the reception, amplifier and decoder stages which convert the input signal into information displayed by the segments of the display module.
The numerical signal, decoding and display are continually monitored.

(1) Signal recognition circuit

This circuit detects a failure in the signal source, the transmission line or an internal failure in the indicator.
When one of these conditions exists the four digit

display extinguishes, thus preventing the display of ambiguous data.

(2) Update recognition circuit

This circuit detects an absence of data update longer than two seconds in duration.
If the indicator is not updated at a rate greater than once every two seconds the four digit display will extinguish until a time when the update rate is greater than once every two seconds.

(3) Bulb failure detect circuitry

The first digit (hundreds) is not monitored. The other three digits (tens, units, tenths) are monitored. Each time a figure is displayed in each of the three digit display tubes, the fault detection circuit compares this display with the continuity of certain segments. When one segment is open (bulb fault) there is a fault warning and the four display segment tubes extinguish.

6. Antenna - Embedded, Starec Type 292

A. Description

The antenna has the form of a covered circular case embedded in the fuselage.
It consists of a radiating slot closed by a dielectric and terminating in a resonant cavity. It is sealed at the level of the matching circuits and has a sealed output pin.

B. Technical Characteristics

- Frequency range	: 960 to 1220 MHz
- Nominal impedance	: 50 ohms
- S.W.R.	: Less than or equal to 2
- Polarization	: Vertical
- Radiation pattern	: Ommdirectional to ± 1 db, aa the antenna is installed on a flat reflector
- Efficiency	: Greater or equal to 75 %
- Maximum allowable power	: 5 KW peak at pressure of 760 to 19 mm Hg
- Weight	: 750 grammes
- Temperature limits	: from - 40 to + 125 degrees Centigrade.

7. Operation of System

A. Principle of Operation (Ref. Fig. 006)

When a VOR frequency is selected on the VOR/ILS/DME control unit, it determines the corresponding DME channel to be used, and thus the reception and transmission frequencies of the DME system.

For example :

VOR F (in MHz)	108.00-10805-10804-10815.....117.90-117.95
DME channel	17X - 174 - 18X - 184 ....126X - 126Y
DME XMTR F. (in MHz)	1041-1041-1042-1042..........1150 - 1150
DME RCVR F (in MHz)	978 - 1104 - 979 - 1105 .....1213 - 1087

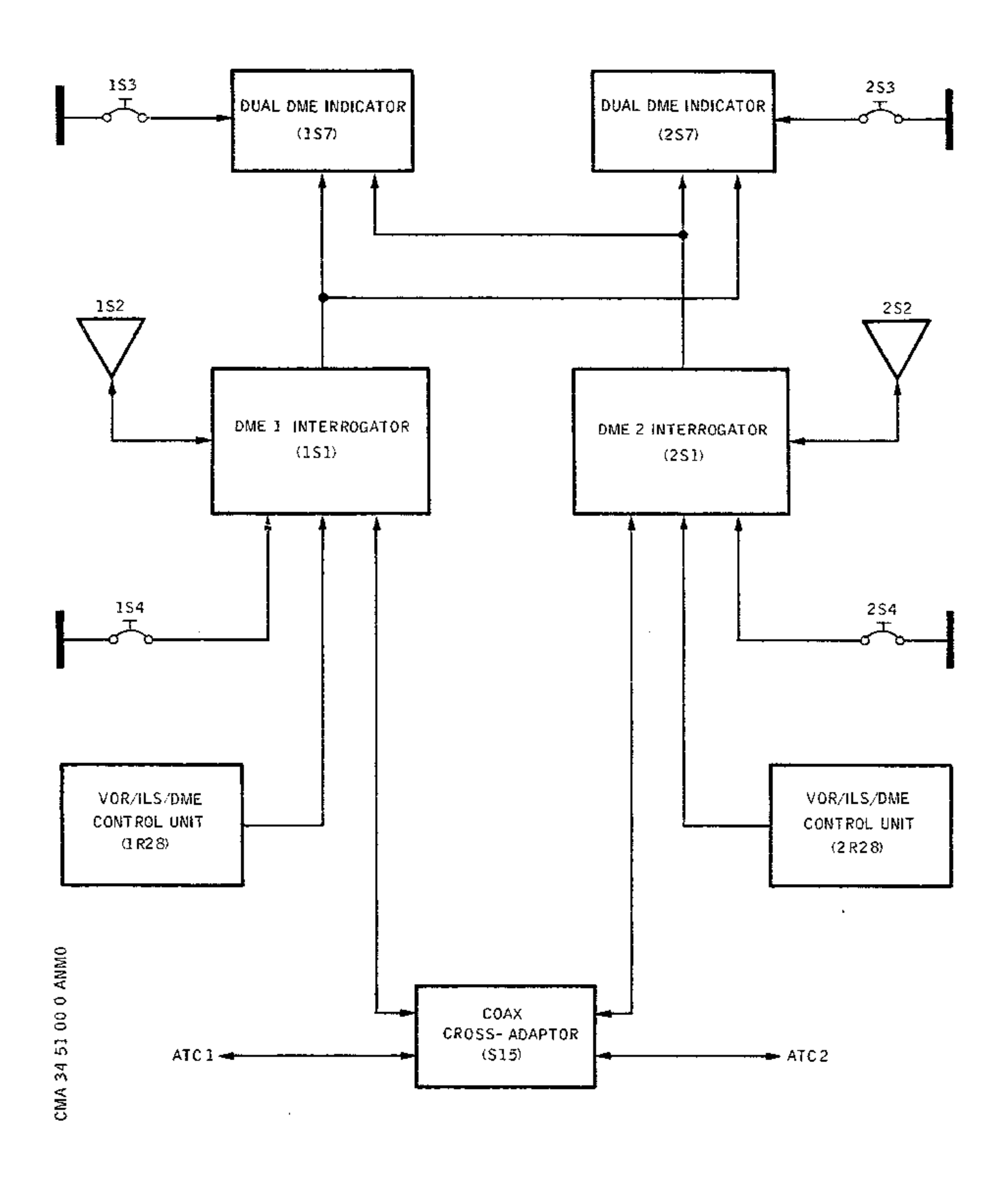
There are 252 channels, made up as follows :
- 126X channels, classed from 1X (134.40 MHz) to 126X (117.90 MHz)
- 126Y channels, classed from 1Y (134.45 MHz) to 126Y (117.95 MHz).

The airborne DME interrogates the DME ground station by transmitting pulse pairs on the receive frequency of the ground station. These pulse pairs are received by the ground station, delayed 50 microseconds and then retransmitted to the airborne DME on the receive frequency of the airborne DME, which is ± 63 MHz away from the ground station frequency.
After the airborne DME transmits an interrogation pulse pair it waits 50 microseconds before beginning to "count out" the time interval prior to receiving the return pulse pair from the DME ground station.
The time between the end of the 50 microsecond period and reception of the return pulse pair is used by the airborne DME to compute the slant range distance to the ground station. This distance is then transformed into binary information and applied to the distance indicators.

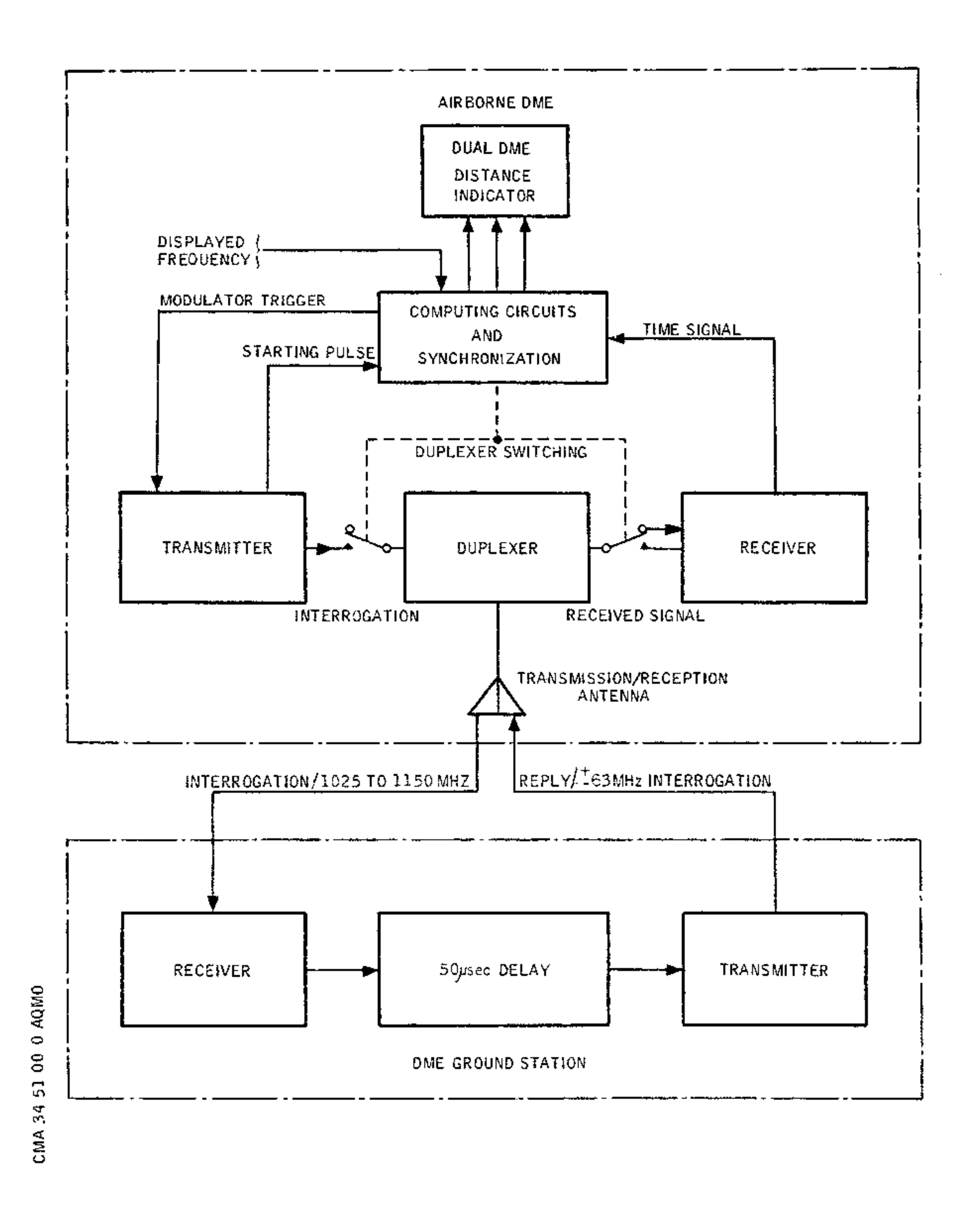
B. Interrogation-Reception (Ref. Fig.007 and 008)

The time required for a radio frequency signal to go one nautical mile (round trip) is 12.36 microseconds. Thus if the round trip time (subtracting the 50 microseconds delay) of the pulse pair is 37.08 microseconds, the ground station is three nautical miles away.

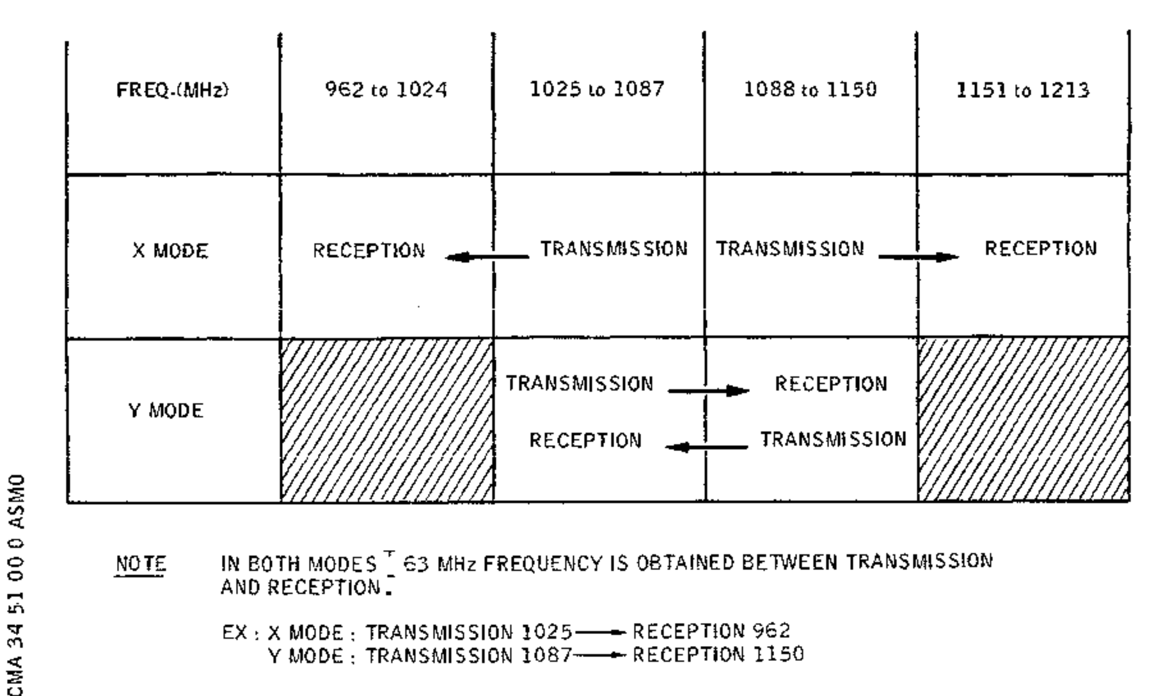
The 50 microsecond delays in both the ground station and the airborne DME allow operation at close range. If the ground station returned the pulse pair to the aircraft without delay, then at close range the airborne DME would still be transmitting the second pulse when the reply to



Operation - Block Diagram
Figure 006



DME - Interrogation - Reception - Schematic
Figure 007



Airborne DME Frequency Bands
Figure 008

the first pulse was received.
With a 50 microsecond delay in both the ground station and the airborne DME a reply at zero miles arrives 50 microseconds after the interrogation.
The DME ground station transmits at a constant rate of 2700 pulse pairs per second, consisting of replies to interrogations by airborne DME's and random pulses, or "squitter".
When the ground station receives more than 2700 pulse pair interrogations per second from airborne DME's it lowers its receiver sensitivity to eliminate the weaker interrogations, and when less than 2700 pulse pair interrogations are received it increases its receiver sensitivity and triggers on random receiver noise pulses to bring the output pulse pair rate back to 2700 per second.
The airborne DME transmit frequency band is from 1025 to 1150 MHz and the ground station transmit frequency band is from 962 to 1213 MHz. There are two modes of operation, X mode and Y mode.

In X mode the airborne DME and the ground station both use 12 microsecond pulse pair spacing. In Y mode the airborne DME pulse pair spacing is 36 microseconds and the

ground station's is 30 microseconds. Y mode ground stations transmit within the airborne DME band and the different pulse spacing from X mode is needed so as not to confuse the ground station with an airborne DME transmitting on the same frequency.

C. Utilization and Determination of Distance to be Displayed (Ref. Fig. 009)

The DME distance is sent from the airborne DME to the distance indicator on three lines : clock, data and synchro.

The clock input is in the form of a square wave with a frequency of 11 ± 3.5 kHz. This clock runs continuously and the data and synchro transmissions are synchronous with it. The distance information is binary coded (ones and zeros), and distance is coded in Binary Coded Decimal (BCD) form.
A BCD code contains four positions A, B, C, D, each one clock cycle long, each of which may either be a high (one) level or a low (zero) level.

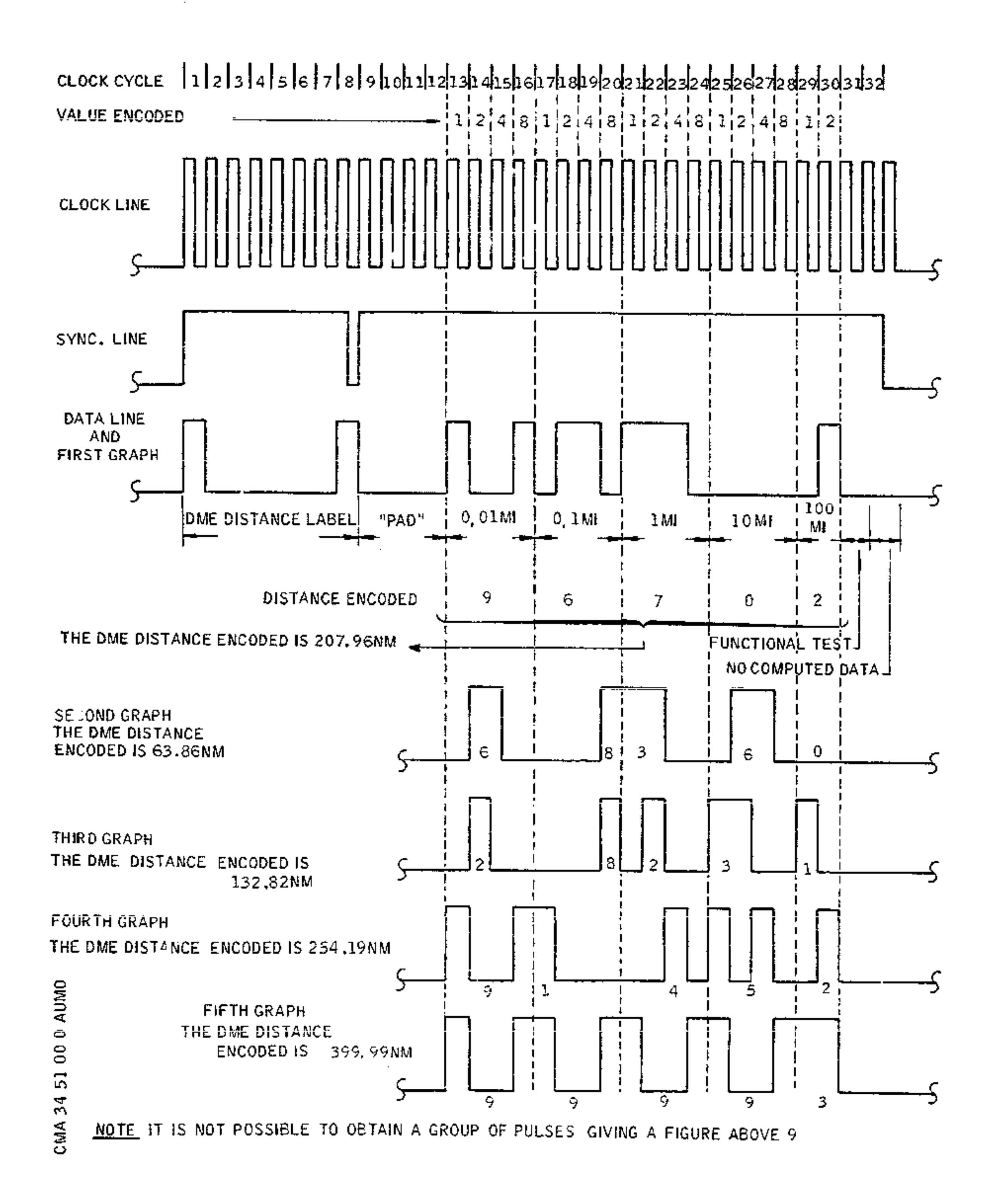
The first position, A (value 1), is transmitted, followed by positions B (value 2), C (value 4), D (value 8). If there is a high level in the position with value 1, and a low level in the positions with value 2, 4 and 8, the decimal number coded is one. If there is a high level in positions with value 4 and 2, and a low level in positions with value 1 and 8, the decimal number coded is six (4 + 2). In this manner decimal numbers 0 through 15 may be encoded. However, in the BCD code used in distance information numbers 0 through 9 are the only numbers transmitted.

The distance data is transmitted during 32 clock cycles in the sequence below :

- During the first clock cycle a "one" is transmitted,
- During clock cycles two through seven a "zero" is transmitted,
- During clock cycle eight a "one" is transmitted.

This makes up the "label" (cycles 1 through 8) which identifies the information to follow as "DME distance".

- During clock cycles 9 through 12, zeros are transmitted to create a "pad" to make the information fit a standard format (32 cycles).
- During clock cycles 13 through 16, one-hundredth nautical mile data is transmitted,
- Clock cycles 17 through 20 define one-tenth mile data,
- Clock cycles 21 through 24 define one mile data,



DME - Data Transmission and Distance Determination
Figure 009

- Clock cycles 25 through 28 define ten mile data,
- Clock cycles 29 and 30 define hundred mile data.

Thus the DME distance is transmitted in the following order :

- Label - pad - 0.01 miles - 0.1 miles - 1 mile - 10 miles - 100 miles.

Clock cycles 31 and 32 define information used to determine the status of the DME.

- A "one" during clock cycle 31 indicates that the DME is undergoing an internal functional test and a "one" during clock cycle 32 indicates that the DME has no computed data to transmit and the indicator displays dashes.

The synchro signal is used to indicate which clock cycles are to be counted and used. When the synchro line goes from a zero to a one, the next clock cycle is called "clock cycle 1".
Distance information is then transmitted using this clock cycle as a reference. The sync line goes to a zero during the last half of clock cycle to signify that the label has been transmitted. This is done to allow equipment which uses more than one information input to "read" the label and select only useful information.

D. System Monitoring

The DME system is continuously monitored for proper operation as well as during testing.
Fault indicators located on the DME interrogator are black when the system operates normally ; they are yellow when the system is faulty.
When a fault is displayed by one of the fault indicators a FLAG ALARM signal is applied to the distance indicator and the distance display extinguishes.
If the receiver or the transmitter fails or performance falls below a certain operational level this is indicated by the R/T fault indicator on the front panel of the interrogator.
If a fault occurs in the ranging circuitry this is displayed by the R/T fault indicator on the front panel of the interrogator and by the fault indicator associated with this circuitry.
If a fault occurs in the distance indicator on the antenna or antenna circuit this is displayed by the corresponding ANT or IND fault indicator on the front panel of the interrogator.
If the indicated fault disappears the display module seg-

ments on the distance indicator are re-supplied and illuminate to display the distance. However, the fault indicators remain yellow. They must be reset manually to display their initial black colour.

E. Tests

When the TEST switch on the VOR/ILS/DME control unit is placed and held in the DME position, a ground is applied to the test start-up control circuit.
The FLAG ALARM signal is applied to the distance indicator, whose display module segments extinguish, for one second. During the next second the display module segments are supplied and display dashes, showing that the system has no computed data to supply. After two seconds a distance of 000.0 NM is displayed on the Captain and First Officer distance indicators (on module in service) and an audio signal is heard over the interphone system.
This distance measurement and the audio signal last as long as the TEST switch on the VOR/ILS/DME control unit is held in DME position.

F. External Suppression Signal

To prevent interference between units operating in the L band (390 to 1550 MHz), each of these units generates an external suppression signal ; this signal is applied from the originating unit to all other units operating in the same band.
When a unit (ATC, for example) is transmitting, the suppression signal is applied to the DME system, the antenna of which is coupled to the transmitter, thereby preventing the display of inaccurate distances. The distance indicator displays dashes to indicate that the DME has no computed data to supply.
Similarly, when the DME system is transmitting a suppression signal is applied to other L-band equipment.

G. Identification

The VOR frequency selected on the VOR/ILS/DME control unit determines which ground station DME channel is to be used. When the reply is transmitted by the ground station part of this information is removed and then applied to the DME interrogator audio frequency circuit.
The identifier information is in the form of a 1350 Hz signal which is applied to the interphone system. The identifier of the DME ground station is heard over the different on-board audio reception devices.

H. Ventilation

The DME interrogators are cooled by the aircraft cooling system. Therefore the ventilators of each interrogator are not connected.

DISTANCE MEASURING EQUIPMENT (DME) - TROUBLE SHOOTING

WARNING : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of the trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a deflect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101). As the two DME systems are identical, Trouble Shooting procedure is described for system 1 only.
R For system 2 Trouble Shooting, use identifiers in parentheses.

2. Prepare

A. In zone 215, remove panel 215DS, to gain access to shelf 7-215 on which the DME interrogators are mounted.

B. Equipment and materials

DESCRIPTION	PART NO.
Electrical Ground Power	
Boomset	Aircraft Equipment
DME Ground Test Unit	
Multimeter	

C. On panel 5-211 make certain that :

(1) On AFCS control unit no mode is engaged, in particular VOR mode.

(2) On Captain and First Officer VOR/ILS/DME control units, function selector is in S/B position.

D. On audio selector panels make certain that :

(1) All square transmission keys are released (keys not illuminated).

(2) No reception push-button is selected

(3) VOICE push-button is released (button not illuminated).

E. Make certain that the following circuit breakers are reset :

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	No.1 INPH SUP	1-213	R 89	K19
R	DME 1 IND	2-213	1S 3	C 8
	DME 1 SUP		1S 4	E 7
	No.2 INPH SUP	3-213	R 90	H 2
	DME 2 IND	13-216	2S 3	B19
	DME 2 SUP		2S 4	G19

F. Connect electrical ground power unit and energize the aircraft network (Ref. 24-41-00, Servicing).

G. Switch on electronics rack ventilation system (Ref. 21-21-00).

H. On Captain (First Officer) jack panel, connect boomset.

I. On Captain (First Officer) audio selector panel select DME 1 (DME 2) on corresponding reception push-button and place integral potentiometer to mid-range to obtain a medium audio level.

J. Make certain that MIC SELECT OXY-BOOM switch is in BOOM position.

3. Trouble Shooting

On panel 5-211, VOR-ILS-DME control unit [1], ([2]) place :
- function switch in DME position
- and hold TEST switch in DME-DN/R position.

Check on dual indicators [3], ([4]) in DME 1 ([DME 2]) windows that :

(a). Initially the four dashes and point disappear then the warning flag is visible.

(b). Secondly the warning flag disappears then the 4 dashes and point are visible.

(c). Thirdly :
- the 4 dashes and point disappear then a distance of 000.0 miles is displayed.
- an aural 1350 Hz signal is audible in boomset.

IF

OK — NOT OK: No aural signal in boomset but distance displayed in DME1 or DME2 windows dual DME on indicators [3],([4]) is correct. Ref.Chart 101.

OK — NOT OK: Aural signal audible in boomset but no distance displayed in DME1, (DME2) windows dual DME on indicators [3], ([4]). Ref. Chart 102.

OK — NOT OK: Aural signal audible in boomset and correct. distance displayed on one indicator only. Replace faulty dual DME indicator [3], ([4])

OK — NOT OK: No TEST operation. DME1, (DME2) windows on dual DME indicators [3], ([4]) display only dashes. Ref. Chart 103.

```
**ON A/C  001-005,
      ||    |
R     ||    |
      ||    |
      ||    |          -------------------------------------------------
      ||    |          | No TEST operation. No display in DME1, (DME2) |
      OK   NOT OK----| windows on dual DME indicators [3], ([4]).   |
      ||    |          | Ref. Chart 104.                               |
      ||    |          -------------------------------------------------
      ||    |
      ||    |          -------------------------------------------------
      ||    |          | Sequence of test is incorrect.                |
      OK   NOT OK----| Replace DME interrogator [5], ([6]).          |
      ||    |          -------------------------------------------------
****************************************************
* Panel 5-211, on VOR-ILS-DME in operation, release *
* TEST selector :                                   *
* - aural signal is no longer audible in boomset.   *
* - In DME1, (DME2) windows on dual DME indicators  *
*   [3], ([4]) the four dashes and point are        *
*   displayed                                    IF *
****************************************************
      ||    |          -------------------------------------------------
      ||    |          | Aural signal and display of test distance in  |
      OK   NOT OK----| DME indicator windows.                        |
      ||               | Replace DME interrogator [5], ([6]).          |
      ||               -------------------------------------------------
      ||
```

```
**ON A/C  006-007,
    ||    |
    ||    |
    ||    |
    ||    |     -------------------------------------------------
    ||    |     | No TEST function, the DME1 (DME2) windows in  |
    OK   NOT OK----| indicators [3], ([4]) are blank. Ref.Chart 104.|
    ||    |     -------------------------------------------------
    ||    |
    ||    |     -------------------------------------------------
    ||    |     | Sequence of test is incorrect.                |
    OK   NOT OK----| Replace DME interrogator [5], ([6]).          |
    ||    |     -------------------------------------------------
*****************************************************
* On panel 5-211, VOR-ILS-DME control unit in       *
* operation, release TEST switch :                  *
* - aural signal is no longer audible in boomset.   *
* - In DME1, (DME2) windows on dual DME indicators  *
*   [3], ([4]) distance displayed is 000.0          *
*   miles for approximate 11-second period. IF      *
*****************************************************
    ||    |     -------------------------------------------------
    ||    |     | Aural signal audible and 4 dashes and point   |
    OK   NOT OK----| displayed on dual DME indicators.             |
    ||          | Replace DME interrogator [5], ([6]).          |
    ||          -------------------------------------------------
    ||
```

```
*****************************************************
* On VOR-ILS-DME control unit [1], ([2]) on panel   *
* 5-211 select frequency of a ground station (with  *
* known call signal and distance) then check that : *
* (a) the aircraft-station distance is displayed in *
* DME1, (DME2) windows on dual DME indicators [3],  *
* ([4])                                             *
* (b) Call signal is audible in boomset.            *
* NOTE : If no ground station can be received, carry*
*        out the test using the ground test unit. IF*
*****************************************************
     ||    |
     ||    |         -----------------------------------------------------
     ||    |        | DME interrogator [5], ([6]) does not calculate     |
     OK    NOT OK----| distance.                                          |
     ||    |        | Ref. Chart 105.                                    |
     ||    |         -----------------------------------------------------
     ||    |
     ||    |         -----------------------------------------------------
     ||    |        | Distance displayed in DME1 and DME2 windows        |
     OK    NOT OK----| on dual DME indicators [3] and [4] is not iden-    |
     ||             | tical.                                             |
     ||             | Replace faulty dual DME indicator [3], ([4]).      |
     ||              -----------------------------------------------------
     ||
*****************************************************
R  * On panel 5-211, VOR-ILS-DME control unit [1],     *
   * ([2]) function switch in OVRD position.           *
   * In DME1, (DM2) windows on dual DME indicators [3],*
   * [4] distance displayed is greater than 200 miles. *
   * (aircraft-ground station or ground test unit dis- *
R  * tance                                      IF     *
*****************************************************
     ||    |
     ||    |         -----------------------------------------------------
     ||    |        | DME interrogator [5], ([6]) does not calculate     |
     OK    NOT OK----| distance greater than 200 miles.                   |
     ||             | Ref. Chart 106.                                    |
     ||              -----------------------------------------------------
*****************************************************
* DME1, (DME2) system is operational                *
*****************************************************
```

```
*************************************
* NO AURAL SIGNAL IN BOOMSET BUT    *
* CORRECT DISTANCE DISPLAYED IN     *
* INDICATOR WINDOWS.                *
*************************************

****************************************************
* On audio selector panel in operation, make certain*
* that :                                           *
* - VOICE push-button is not engaged, button not   *
*   illuminated.                                   *
* - DME reception push-button engaged, button illum-*
*   inated.                                        *
* - potentiometer integral with push-button is set *
*   to mid-range.                                  *
****************************************************
                         |
                        YES
                         |
****************************************************
* Check DME reception at another audio selector    *
* panel, positioning controls as described in      *
* prepare procedure.                               *
* Aural signal reception correct at this position. *
****************************************************
             |                             |
            YES                            NO
             |                             |
-------------------------------  -----------------------------------
| Replace faulty audio selector|  | Replace faulty DME interrogator |
| panel [7], [8], [9] or [10]. |  | [5], ([6]).                     |
-------------------------------  -----------------------------------
```

Chart 101

```
**************************************--------------------------------
* AURAL SIGNAL AUDIBLE IN BOOMSET BUT*| GROUND EQUIPMENT REQUIRED   |
* NO DISTANCE DISPLAYED IN INDICATOR *|-----------------------------|
* WINDOWS                            *| DESCRIPTION       PART NO.  |
**************************************|-----------------------------|
                                      | MULTIMETER                  |
                                      -------------------------------

*****************************************************
* Replace faulty DME interrogator [5], ([6])        *
*****************************************************
                |
                |
                |     ----------------------------------------------
                NO---| Check 26VAC at output of circuit breaker [11] |
                     | ([12]).                                      |
                      ----------------------------------------------
                                      |
                                      NO
                                      |
-----------------------------------------------------
| Check for presence of 26VAC at input of circuit   |
| breaker [11], ([12]).                             |
-----------------------------------------------------
                 |                       |
                 NO                      YES
                 |                       |
-----------------------------------  ---------------------------------
| Ref. 24-41-00, trouble shooting |  | Replace circuit breaker [11]   |
-----------------------------------  | ([12]).                        |
                                     ---------------------------------
```

Chart 102

* NO TEST OPERATION. INDICATOR WINDOWS DISPLAY ONLY DASHES.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

* On panel 5-211, remove and disconnect VOR-ILS-DME control unit [1], ([2]) from aircraft wiring.
* On removed control unit :
* (a) Connect terminals W and X to multimeter. Place and hold TEST switch in DME DN/R position and check that there is continuity. Release selector, there is no longer continuity.
* (b) Connect terminals W and H to multimeter, place function switch in S/B position and check that there is continuity. Place switch in DME position, there is no continuity.

YES: Replace faulty interrogator [5] ([6]).

NO: Replace faulty control unit [1] ([2]).

Chart 103

**ON A/C 001-005,

```
************************************-------------------------------
* NO TEST OPERATION, DME INDICATOR   *| GROUND EQUIPMENT REQUIRED   |
* WINDOWS ARE BLANK                  *|-----------------------------|
**************************************| DESCRIPTION        PART NO. |
                                      |-----------------------------|
                                      | MULTIMETER                  |
                                      -------------------------------

*************************************************************
* Shelf 7-215, on DME interrogator front panel [5],         *
* ([6]), check that R/T fault warning light is yellow.*
*************************************************************
            |                                      |
           YES                                     NO
            |                                      |
----------------------------------   ----------------------------------
| Replace faulty DME interrogator|   | Check 115 VAC at output of     |
| [5], ([6]).                    |   | circuit breaker [13], ([14]).  |
----------------------------------   ----------------------------------
                                              |
                                              NO
                                              |
----------------------------------------------------
| Check presence of 115 VAC at input of circuit    |
| breaker [13], ([14]).                            |
----------------------------------------------------
              |                               |
              NO                             YES
              |                               |
----------------------------------   ----------------------------------
| Ref. 24-41-00, Trouble Shooting|   | Replace circuit breaker [13],  |
----------------------------------   | ([14]).                        |
                                     ----------------------------------
```

Chart 104

**ON A/C 006-007,

```
**************************************-------------------------------
* NO TEST OPERATION, DUAL DME INDI-   *| GROUND EQUIPMENT REQUIRED    |
* CATOR WINDOWS ARE BLANK             *|------------------------------|
**************************************| DESCRIPTION        PART NO.  |
                                       |------------------------------|
                                       | MULTIMETER                   |
                                       --------------------------------

*******************************************************
* Trip circuit breakers [13] and [14].                *
* Interchange DME interrogators [5] and [6].          *
* Reset circuit breakers then repeat self-test.       *
* Sequence of test is correct.                        *
*******************************************************
              |                                 |
             YES                                NO
              |                                 |
----------------------------------  ---------------------------------
| Replace faulty DME interrogator|  | Check 115 VAC at output of    |
| [5], ([6]).                    |  | circuit breaker [13], ([14]). |
----------------------------------  ---------------------------------
                                                |
                                                NO
                                                |
-----------------------------------------------------
| Check presence of 115 VAC at input of circuit     |
| breaker [13], ([14]).                             |
-----------------------------------------------------
                 |                              |
                 NO                            YES
                 |                              |
----------------------------------  ---------------------------------
| Ref. 24-41-00, Trouble Shooting|  | Replace faulty circuit breaker|
----------------------------------  | ([13]), ([14]).               |
                                    ---------------------------------
```

R Chart 104

```
**ON A/C  001-005,
*************************************
* DME INTERROGATOR IN OPERATION DOES *
* NOT CALCULATE DISTANCE.            *
*************************************


*****************************************************
* Shelf 7-215, on DME interrogator front panel [5], *
* ([6]), check state of ANT fault indicator.        *
*****************************************************
                  |                            |
---------------------------------  ---------------------------------
| If ANT fault indicator is     |  | If ANT fault indicator is     |
| yellow, press RESET push-     |  | black, place VOR in operation |
| button. Indicator remains     |  | without changing frequency sel-|
| yellow.                       |  | ected on DME.                 |
---------------------------------  | VOR operation correct.        |
                |                  ---------------------------------
               YES                   |                         |
                |                    |                         |
---------------------------------    |                        NO
| Replace faulty antenna [15],  |    |                         |
| ([16]).                       |    |                         |
---------------------------------    |                         |
                                    YES   ----------------------------
                                     |    | Replace faulty VOR-ILS-DME|
--------------------------------------    | control unit [1], ([2]).  |
| Replace faulty DME interrogator    |    ----------------------------
| [5], ([6]).                        |
--------------------------------------
                 |
              NOT OK
                 |
--------------------------------------
| Replace faulty antenna [15], ([16])|
--------------------------------------
```

R Chart 105

```
**ON A/C  006-007,
*************************************
* DME INTERROGATOR IN OPERATION DOES *
* NOT CALCULATE DISTANCE.            *
*************************************


****************************************************
* Trip circuit breakers [13] and [14].             *
* Interchange DME interrogators [5] and [6].       *
* Reset circuit breakers then check on indicators  *
* distance displayed corresponds to ground station *
* or that displayed on ground test unit.           *
****************************************************
            |                          |
           YES                         NO
            |                          |
--------------------------------  ----------------------------------
| Replace faulty DME regulator  | | Operate VOR without changing   |
| [5], [6].                     | | frequency displayed on DME     |
|                               | | VOR operation correct.         |
--------------------------------  ----------------------------------
                                   |                        |
                                  YES                       NO
                                   |                        |
                                   |    ---------------------------
                                   |    | Replace faulty VOR-ILS-DME|
                                   |    | control unit [1], [2].    |
                                   |    ---------------------------
                                   |
------------------------------------
| Replace faulty antenna [15], ([16])|
------------------------------------
            |
            NO
            |
------------------------------------
| Replace faulty DME interrogator  |
| antenna coaxial cable.           |
------------------------------------
```

R Chart 105

```
**************************************-------------------------------
* INTERROGATOR IN OPERATION DOES NOT *| GROUND EQUIPMENT REQUIRED   |
* CALCULATE DISTANCE GREATER THAN 200*|-----------------------------|
* MILES.                             *| DESCRIPTION        PART NO. |
**************************************|-----------------------------|
                                      | MULTIMETER                  |
                                      -------------------------------

*******************************************************
* On panel 5-211, remove and disconnect VOR-ILS-DME *
* control unit [1], ([2]) from aircraft wiring.     *
* On removed control unit :                         *
* (a) Connect terminals W and J to multimeter, place*
*     function switch in OVRD position and check    *
*     that there is continuity.                     *
*******************************************************
                 |                            |
                 |                            |
                YES                           NO
                 |                            |
                 |                            |
--------------------------------  -----------------------------------
| Replace faulty interrogator  |  | Replace faulty control unit [1] |
| [5], ([6]).                  |  | ([2]).                          |
--------------------------------  -----------------------------------
```

R Chart 106

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[1] VOR-ILS-DME Control unit		5-211	1R28	Flight Compart-ment	34-55-13 R/I	34-51-01 34-51-11
[2] VOR-ILS-DME Control unit		5-211	2R28	Flight Compart-ment	34-55-13 R/I	34-51-05 34-51-51
[3] Dual DME Indicator		2-211	1S7	Flight Compart-ment	34-51-23 R/I	34-51-01 34-51-12
[4] Dual DME Indicator		2-212	2S7	Flight Compart-ment	34-51-23 R/I	34-51-05 34-51-52
[5] DME Interrogator		7-215	1S1	LH Elec-tronics Rack	34-51-33 R/I	34-51-01 34-51-11
[6] DME Interrogator		7-215	2S1	LH Elec-tronics Rack	34-51-33 R/I	34-51-05 34-51-51
[7] Audio Selector panel		7-211	R53	Flight Compart-ment	23-41-21 R/I	34-51-13 34-51-53
[8] ditto		7-211	R54	ditto	ditto	ditto
[9] ditto		7-213	R55	ditto	ditto	ditto
[10] ditto		8-214	R56	ditto	ditto	ditto
[11] Circuit breaker 26VAC		2-213	1S3	Map Ref. C 8	24-50-00 R/I	34-51-01 34-51-11
[12] Circuit breaker 26 VAC		13-216	2S3	Map Ref. B 19	24-50-00 R/I	34-51-05 34-51-51
[13] Circuit breaker 115VAC		2-213	1S4	Map Ref. E 7	24-50-00 R/I	34-51-01 34-51-11

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[14] Circuit breaker 115VAC		13-216	2S4	Map Ref. G 19	24-50-00 R/I	34-51-05 34-51-51

Component Identification
Table 101

DISTANCE MEASURING EQUIPMENT (DME) - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
One Boomset	Aircraft Equipment

B. Prepare

(1) On panel 5-211 :

(a) Make certain that on automatic pilot control box no mode is engaged, particularly VOR mode :

(b) Check that function selectors on VOR/ILS/DME control unit, Captain and First Officer, are in S/B position.

(2) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No.1 INPH SUP		R 89	K19
DME1 IND	2-213	1S 3	C 8
DME1 SUP		1S 4	E 7
No.2 INPH SUP	3-213	R 90	H 2
LH DASH INST LTS SUP	13-215	L 372	A12
DME2 IND	13-216	2S 53	B19
RH DASH INST LTS SUP		L 371	E 9
DME2 SUP		2S 4	G19
CTR DASH & G/SHIELD LTS SUP	14-216	L 375	D10
LH DIGITAL DISPLAY DIMMING SUP	1-213	L1211	L18

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH DIGITAL DISPLAY DIMMING SUP	15-216	L1216	A13

(3) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(4) Switch on electronics rack ventilation system and make certain that it is operating correctly. (Ref. 21-21-00).

(5) On centre console 7-211, Captain audio selector panel, make certain that :

(a) All square transmission keys are released

(b) All reception selection push-buttons are released.

(c) VOICE push-button is released (extinguished).

(6) On panel 1-211, Captain jack panel. Connect boomset to HEADSET and mic jacks on BOOM SET assembly.

(7) On centre console 7-211, Captain audio selector panel.

(a) Engage NAV 1 and NAV 2 reception selection push-buttons and set integral potentiometers to mid-range.

(b) Make certain that BOOM-MASK selector switch is in BOOM position.

C. Test

NOTE : The two DME systems are identical and only DME1 test is described. For DME2 system test use identifiers in parentheses.

(1) Lighting check :

(a) On panel 12-211, adjust LH DASH INSTRUMENTS potentiometer to a convenient level of illumination of face of Captain indicator.

(b) On panel 5-212, adjust RH DASH INSTRUMENTS potentiometer to a convenient level of illumination of face of First Officer indicator.

(c) In windows of Captain and First Officer dual DME indicators :

- dashes and point appear.

(d) On panel 1-211, adjust DIGITS potentiometer in order to have correct illumination of dashes in windows of Captain indicator.

(e) On panel 1-212, adjust DIGITS potentiometer in order to have correct illumination of dashes in windows of First Officer indicator.

(f) On panel 4-211, vary GLARESHIELD potentiometer and check that Captain and First Officer VOR/ILS/DME control unit lighting varies.

(2) DME1 (DME2) check in self-test mode.

NOTE : This test can be carried out with aircraft in hangar with function selector on Captain (First Officer) VOR/ILS/DME control unit in S/B position, allow equipment to warm up for approximately one minute.

(a) On panel 5-211, on Captain (First Officer) VOR/ILS/DME control unit :

(a1) Place selector S/B-DME-OVRD in DME position.

(a2) Place and hold TEST selector switch in DME DN/R position.

(b) On Captain and First Officer dual DME indicators, check that in DME1 (DME2) windows :

(b1) Initially, the four dashes and point disappear, then the warning flag is visible.
(b2) Secondly, the warning flag disappears, then the four dashes and point appear.

(b3) Thirdly,
- the four dashes and point disappear, then a distance of 000.0 Miles or 000.1 Miles is displayed.
- a 1350 Hz aural signal is audible in the boomset

(c) On VOR/ILS/DME control unit in use release TEST selector switch.

(c1) The aural signal stops

**ON A/C 001-005,

(c2) On Captain and First Officer dual DME indicators, four dashes and point are displayed in DME1, (DME2) windows.

**ON A/C 006-007,

(c2) On Captain and First Officer dual DME indicators, distance reading is 000.0 Miles or 000.1 Miles for 11 second period approximately.

(3) Check of DME1 (DME2) with ground station.

NOTE : To obtain good reception of ground station signals this check is made with aircraft outside hangar.

(a) On Captain (First Officer) VOR/ILS/DME control unit :

(a1) Make certain that S/B-DME-OVRD function selector is in DME position.

(a2) By means of frequency selector switches, select frequency of ground station.

(b) After approximately 30 seconds, make certain that ground station call sign is audible in boomset.

(c) On Captain and First Officer dual DME indicators, make certain that in DME1 (DME2) windows :

(c1) 4 dashes and point are visible so long as interrogator is in search mode.

(c2) After some seconds 4 dashes and point disappear and ground station distance is displayed.

(d) On Captain audio selector panel :

(d1) Turn potentiometer integral with NAV1 (NAV2) push-button and check its action, then return to mid range.

(d2) Engage VOICE ONLY push-button and check on boomset that audible signal has disappeared.

(d3) Release VOICE ONLY push-button. Aural signal is audible again.

D. Close-Up

(1) On Captain (First Officer) VOR/ILS/DME control units.

(a) Select frequency different from that of ground station.

(a1) Distance reading on Captain and First Officer dual DME indicators disappears.

(a2) Aural signal is no longer audible in boomset.

(b) Place S/B-DME-OVRD function selector in S/B position.

(b1) On Captain and First Officer dual DME indicators, 4 dashes and point appear in DME1 (DME2) windows.

(2) On Captain audio selector panel :

(a) Release NAV1 (NAV2) reception selection push-buttons, and turn potentiometers integral with buttons to counterclockwise stops.

(3) On Captain jackbox, disconnect boomset.

(4) On panels 1-211 and 1-212, place DIGITS potentiometers in zero position.

(5) On panel 12-211 and 5-212, place LH DASH INSTRUMENT and RH DASH INSTRUMENT control buttons in zero position.

(6) Switch off electronics rack ventilation system (Ref. 21-21-00).

(7) De-energize aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
DME Ground Test Unit (COLLINS 475 D1 or Similar)	
From Test Unit : - Two Boomsets - Ground Service Telephone with Headset	TE2037-000

B. Prepare

(1) Position ground test unit under DME antenna of system to be checked :

- DME1 assembly, zone 113
- DME2 assembly, zone 132.

NOTE : Position test unit cover, used as an antenna, facing aircraft DME antenna.

(2) Put into operation DME ground test unit.

(3) Connect ground service telephone :

(a) To ground service jack R73 located in nose (access door 113RB).

(b) To ground service jack R83 located in baggage compartment (access door 131AZ).

(4) Repeat Prepare procedure in operational test (Ref. para. 1. B.).

C. Test

NOTE : The two DME systems are identical and only DME1 test is described. For DME2 system test use identifiers in parentheses.

(1) Lighting check

Repeat check described in Operational test, paragraph 1-C-(1).

(2) Check of DME1 (DME2) in self-test mode.

Repeat check described in operational test, paragraph 1-C-(2).

(3) Check of DME1 (DME2) with test unit.

(a) Panel 5-211 :

(a1) On Captain (First officer) VOR/ILS/DME control unit, place S/B-DME-OVRD selector in DME position.

(a2) On First Officer (Captain) VOR/ILS/DME control unit, place S/B-DME-OVRD selector in S/B position.

(b) Adjust and calibrate DME ground test unit according to unit documentation, then set distance selector for short range (for example,5 nautical miles).

(c) On Captain (First Officer) VOR/ILS/DME control unit, select in window transmission frequency of DME ground test unit.

(d) On Captain and First Officer dual DME indicators, in DME1 (DME2) windows :

(d1) Dashes are visible for approximately one second (DME interrogator in search mode).

(d2) After one second, distance reading in each window is identical and corresponds to distance selected on ground test unit.

(d3) Check on boomset for presence of audible signal.

(e) On DME ground test unit, set distance selector for range of approximately 180 Nm.

(f) On Captain and First Officer dual DME indicators, in DME1 (DME2) windows :

(f1) Dashes are visible for approximately one second (DME interrogator in search mode).

(f2) After one second, distance reading in each window is identical and corresponds to distance selected on ground test unit.

(f3) Check on boomset for presence of audible signal.

(f4) On Captain audio selector panel, engage VOICE push-button and check that there is no longer an audible signal in boomset.

(f5) Release VOICE push-button and check that signal is again audible in boomset.

(g) On DME ground test unit, set distance selector for long range (for example, 270 Nm).

(h) On Captain (First Officer) VOR/ILS/DME control unit, place S/B-DME-OVRD selector in OVRD position.

(i) On Captain and First Officer dual DME indicators, in DME1 (DME2) windows :

(i1) Dashes are visible for approximately one second (DME interrogator in search mode).

(i2) After one second, distance reading in each window is identical and corresponds to distance selected on ground test unit.

(i3) Check on boomset for presence of audible signal.

(j) On Captain (First Officer) VOR/ILS/DME control unit, place S/B-DME-OVRD selector in DME position and check :

(j1) That on Captain and First Officer DME indicators, in DME1 (DME2) windows dashes are visible (DME interrogator in search mode).

(j2) On DME ground test unit, place distance selector in 180 Nm position.

(k) On LH side console 1-211, disconnect boomset from connectors on Captain jack panel

(l) On RH side console 1-212 connect boomset to BOOMSET jacks on First Officer jack panel.

(m) On centre console 7-211, First Officer audio selector panel :

(m1) Make certain that no separe transmission key

is engaged.

(m2) Make certain that Boom-mask selector is in Boom position.

(m3) Engage push-buttons NAV1 and 2, then turn their integral potentiometers to check their operation and return then to mid-range.

(m4) Engage VOICE push-button and check in boomset that DME aural signal has disappeared.

(m5) Release VOICE push-button, aural signal is again audible in boomset.

(n) On RH side console 1-212, disconnect boomset from boomset jacks on jack panel.

(o) On Flight engineer panel 8-214 connect boomset to BOOMSET jacks on jack panel.

(p) On Flight engineer panel 8-214, audio selector panel :

(p1) Make certain that no sqare transmission key is engaged.

(p2) Make certain that BOOM-MASK selector is in Boom position.

(p3) Engage reception push-buttons NAV1 and 2, turn their integral potentiometers to check their operation and return them to mid-range.

(p4) Release VOICE push-button, aural signal is again audible in boomset.

(q) On Flight Engineer panel 8-214, disconnect boomset from BOOMSET jacks on jack panel.

(r) On First observer panel 7-213

(r1) Connect boomset to BOOMSET jacks on jack panel.

(r2) On the audio selector panel
- make certain that no square transmission key is engaged.
- make certain that BOOM-MASK selector is in MASK position.
- Engage reception push-buttons NAV1 and 2,

turn their integral potentiometers to check their operation and return them to mid-range.

- Engage VOICE push-button and check in boomset that DME aural signal has disappeared.
- Release VOICE push-button, aural signal is again audible in boomset.

(s) On panel 5-211, Captain (First Officer) VOR/ILS/DME control unit, place function selector in S/B position.

(s1) On Captain and First Officer dual DME indicators, 4 dashes and point are visible in DME1 (DME2) windows.

(t) On DME ground test unit, set distance selector to minimum range.

D. Close-Up

(1) Disconnect ground service telephone from ground service jacks.

(2) Switch off DME ground test unit following instructions in unit documentation.

(3) On panel 7-213, disconnect boomset from BOOMSET jacks on jack panel.

(4) On Captain, First Officer, Flight Engineer and 1st supernumerary audio selector panels, release reception push-buttons NAV1 and 2 and turn integral potentiometers to counterlockwise stop.

(5) On panels 1-211 and 1-212, return DIGITS potentiometers to zero position.

(6) On panels 12-211 and 5-212, return LH DASH INSTRUMENT and RH DASH INSTRUMENT control buttons to zero position.

(7) Switch off electronics rock ventilation system (Ref. 21-21-00).

(8) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

3. System Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
DME Ground Test Unit SWR meter (1000 Mhz)	
From Test Unit : - Two Boomsets - A Ground Service Telephone with Headset	TE2037-000

B. Prepare

(1) Repeat Prepare procedure for functional test. (Ref. para. 2. B.).

C. Test

NOTE : The two DME systems are identical, only DME1 test is described. For DME2 system test, use identifiers in parentheses.

(1) Lighting check

Refer to functional test, ref. paragraph 2. C. (1).

(2) DME1 (DME2) check in self-test mode

Refer to functional test, ref. paragraph 2. C. (2).

(3) SWR measurement :

(a) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
DME1 IND	2-213	1S	3	C 8
DME1 SUP		1S	4	E 7
DME2 IND	13-216	2S	3	B19
DME2 SUP		2S	4	G19

(b) Connection of SWR meter for DME1 (DME2) :

(b1) Remove DME1 (DME2) interrogator (1S1) from shelf 7-215.

(b2) On connector 1S1-AA (2S1-AA) on shelf 7-215, connect SWR meter to coaxial terminal 2 from antenna 1S1-AA-2 (2S1-AA-2).

(c) Measure SWR value (coaxial cable and antenna) on following three frequences : 960 MHz - 1090 MHz - 1220 MHz.
SWR value must be maximum 2.

(d) Disconnect SWR meter from connector 1S1-AA, (2S1-AA), coaxial terminal 2, install DME1 (DME2) interrogator on shelf 7-215.

(e) Reset circuit breakers previously tripped in paragraph 3-C-(3)-(a).

(f) Position SWR meter.

(4) Check of DME1 (DME2) with ground test unit.

(a) Carry out functional test in paragraphs 2-C-3-(a) to 2-C-3-(r).

(b) On 1st supernumerary panel 7-213, disconnect boomset from BOOMSET jacks on jack panel.

(c) On LH side console 1-211, connect boomset to BOOMSET jacks on jack panel.

(d) On DME ground test unit :

(d1) Set distance selector to minimum range.

(d2) Switch off DME ground test unit following instructions in unit documentation.

(5) Simultaneous test of both DME systems with ground station.

NOTE : This test enables a precise comparison of distances given by the two DME systems to be made, and detection of possible mutual interference between the systems.

To obtain good reception of ground station signals it is preferable to carry out this

test with the aircraft outside the hangar.

(a) On panel 5-211, Captain and First Officer VOR/ILS/DME control units :

(a1) Place S/B-DME-OVRD selector in DME position.

(a2) By means of frequency selectors, select frequency of ground station.

(b) On Captain and First Officer dual DME indicators, make certain that in DME1 and DME2 windows :

(b1) The dashes are visible while the interrogators are in search mode.

(b2) After some seconds the dashes disapper and distance indicated in each of the 4 windows is identical.

(b3) In boomset the ground station call signal is audible.

(c) On panel 5-211, Captain and First Officer VOR/ILS/DME control units :

(c1) Select a frequency different from ground station frequency.

(c2) Place function selector in S/B position.

(c3) On Captain and First Officer dual DME indicators display of 4 dashes and point is inhibited in DME1 and DME2 windows.

(c4) Local ground station signal is no longer audible.

D. Close-Up

(1) Disconnect ground service telephone from ground service jacks.

(2) On LH side console, panel 1-211, disconnect boomset from BOOMSET jacks on jack panel.

(3) On Captain, First Officer Flight engineer and 1st supernumerary audio selector panels, release reception push-buttons NAV1 and 2 and turn incorporated potentiometers to counterlockwise stop.

(4) On panels 1-211 and 1-212 return DIGITS potentiometer controls to zero.

(5) On panels 12-211 and 5-212 return LH DASH INSTRUMENT and RH DASH INSTRUMENT controls to zero.

(6) Switch of electronics rack ventilation system (Ref. 21-21-00).

(7) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

DISTANCE MEASURING EQUIPMENT (DME) ANTENNA REMOVAL/INSTALLATION

1. General

Removal for replacement or check. DME1 system consists of the antenna (1S2) in the droop nose in zones 113-114. DME2 system consists of the antenna (2S2) located between frames 30 and 31 (zones 131-132). Antennas of the two systems are identical.

2. DME Antenna

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Access Platform, Height of Access 3.972 m (13 ft)	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

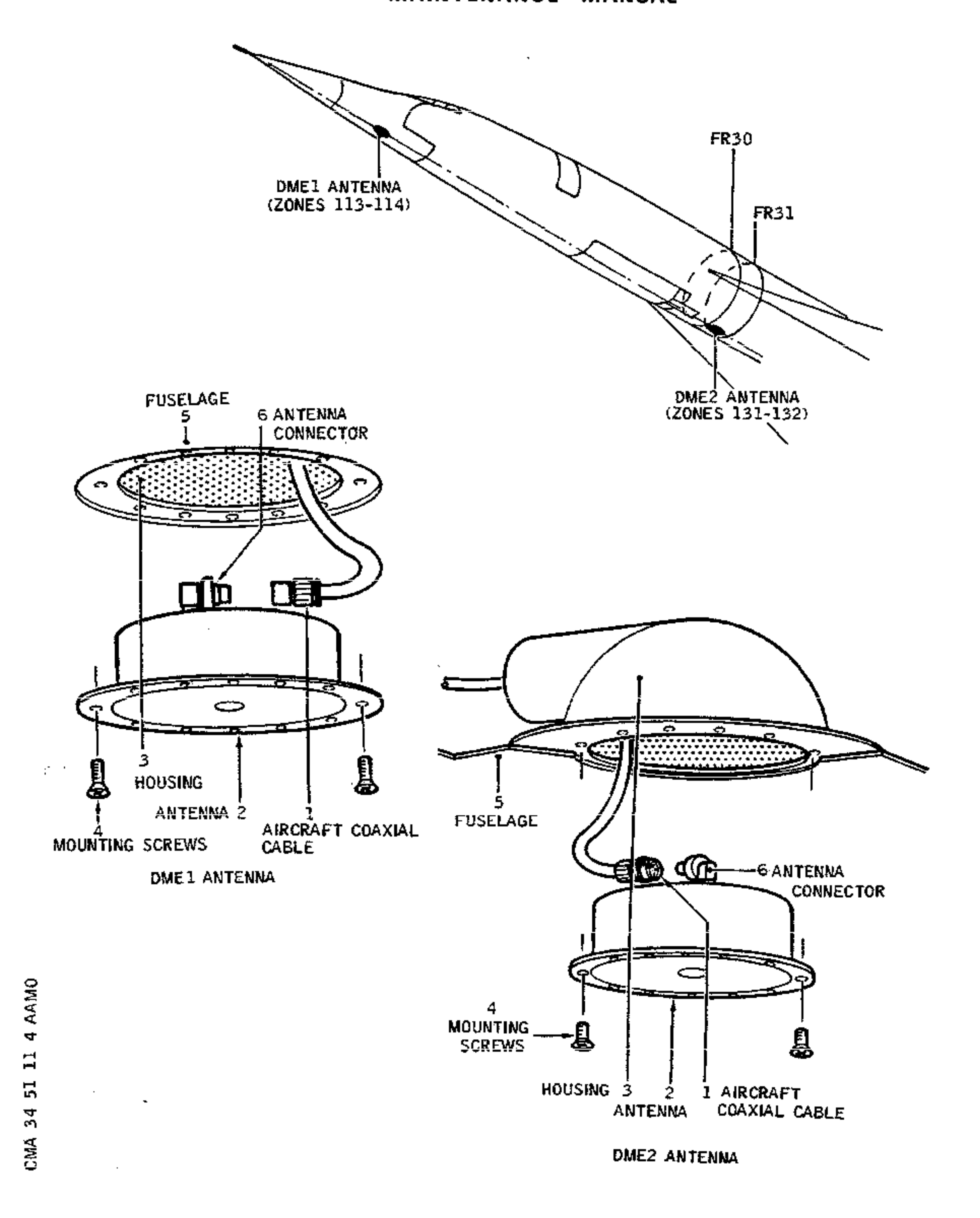
SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DME1 IND	2-213	1S 3	C 8
DME1 SUP		1S 4	E 7
DME2 IND	13-216	2S 3	B19
DME2 SUP		2S 4	G19

(2) Position access platform beneath DME antenna for removal, either in zone 113-114 for DME1 or in zone 131-132 (between frames 30 and 31) for DME2.

C. Remove (Ref. Fig. 401)

(1) Loosen and remove the 12 mounting screws (4) while manually supporting antenna (2).

(2) Remove antenna (2) from its housing (3) and disconnect aircraft coaxial cable (1) from antenna connector (6).



DME Antenna : Removal/Installation
Figure 401

(3) Clean antenna mounting area on fuselage (5).

(4) Check condition of aircraft coaxial connector.

D. Preparation of Replacement Component

(1) Make certain that antenna is in good external condition and particularly that connector has no trace of corrosion.

E. Install

(1) Position antenna (2) near its housing (3) and connect aircraft coaxial cable (1) to antenna connector (6).

(2) Position antenna facing its housing on fuselage (5), while supporting antenna install 12 mounting screws (4).

(3) Tighten the 12 mounting screws.

F. Tests

(1) Remove safety clips and tags and reset the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
DME1 IND	2-213	1S	3	C 8
DME1 SUP		1S	4	E 7
DME2 IND	13-216	2S	3	B19
DME2 SUP		2S	4	G19

(2) Carry out Prepare procedure for operational test (Ref. 34-51-00, Adjustment/Test).

R **ON A/C 001-005,

(3) Check operation of DME1(DME2) system, using local
R station (Ref. Operational test, 34-51-00, Adjustment/Test).

R NOTE : If the check is carried out at a location in
R which there is no ground station proceed as follows :
- remove panel 215DS to gain access to shelf 7-215.

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- Panel 5-211, on VOR/ILS/DME control unit of system under test, place function selector in DME position.
- On front panel of interrogator in operation, press RESET push-button and check that ANT annunciator is black.
- Install access door 215DS.

R **ON A/C 006-007,
R (3) Check DME1 (DME2) system operation utilizing ground
R station (Ref. Operational test, 34-51-00, Adjustment/
R Test)
R NOTE : If there is no ground station at the location
R in which the check is being carried out, perform an SWR
R check (Ref. System test, 34-51-00, Adjustment/Test).

(4) Carry out Operational test Close-up procedure (Ref. 34-51-00, Adjustment/Test).

G. Close-Up

(1) Remove access platform from working area.

DUAL DME INDICATOR - REMOVAL/INSTALLATION

1. General

The indicators are installed, on the Captain (2-211) and First Officer (2-212) instrument panels. The indicators cannot be directly withdrawn from the front of the instrument panels because of insufficient wiring length, and may necessitate removal/installation of other equipment.

2. Removal/Installation

NOTE : As the indicator consists of two identical modules, the connectors must be correctly identified during removal and installation.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On Captain and First Officer side consoles 1-211 and 1-212, make certain that DIGITS knobs are in OFF position.

(2) On Captain and First Officer side panels 12-211 and 5-212 make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(3) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DME1 IND	2-213	1S 3	C 8
DME1 SUP		1S 4	E 7
LH DASH INST LTS SUP.	13-215	L 372	A12
DME2 IND	13-216	2S 3	B19
RH DASH INST LTS SUP		L 371	E 9
DME2 SUP		2S 4	G19

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH DIGITAL DISPLAY DIMMING SUP	1-213	L1211	L18
RH DIGITAL DISPLAY DIMMING SUP	15-216	L1216	A13

C. Remove (Ref. Fig. 401)

(1) First officer DME indicator.

(a) Loosen and remove the four adaptor plate (3) mounting screws (4).

(b) Remove adaptor plate (3).

(c) Carefully remove DME dual indicator (2) from its seating (8). Support indicator.

(d) Under instrument panel, disconnect the two connectors (7) from indicator.

(e) Withdraw DME dual indicator (2).

(f) Cap electrical connectors (6) and (7).

(2) Captain DME indicator

(a) Procedure identical with First Officer DME indicator removal.

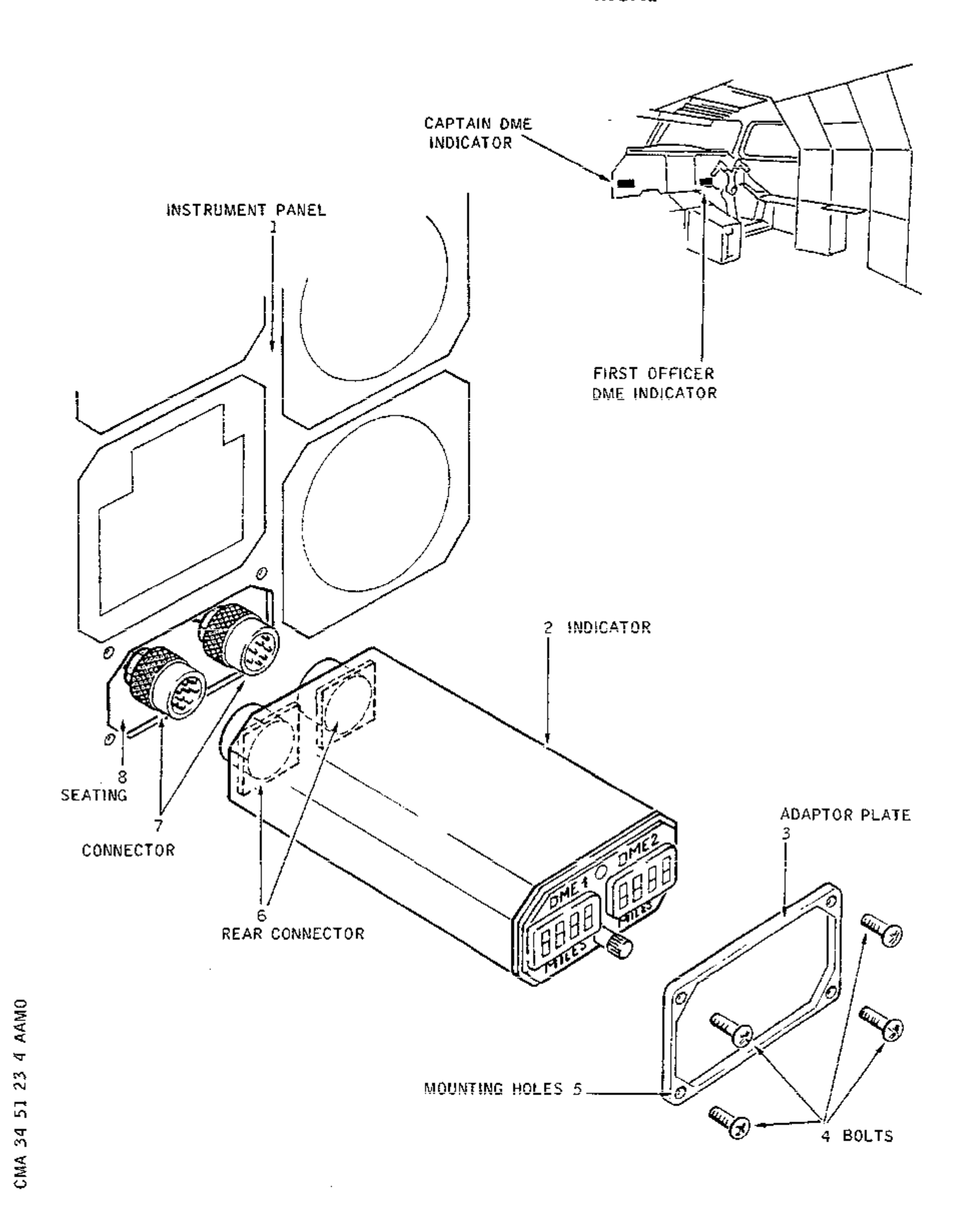
D. Preparation of Replacement Component

(1) Make certain that indicator seating is clean and that connectors and aircraft wiring are in correct condition.

(2) Visually check indicator for correct external condition, that connectors are undamaged and have no traces of corrosion.

E. Install
(Ref. Fig. 401)

(1) First officer DME indicator



Removal/Installation of a DME Indicator
Figure 401

(a) Remove blanking caps from connectors (6) and (7).

(b) Position DME dual indicator (2) facing its seating (8) and carefully install.

(c) Under instrument panel, connect aircraft connectors (7) to indicator receptacles (6).

(d) Push DME dual indicator (2) fully against instrument panel (1).

(e) Position adaptor plate (3) and install and tighten the 4 mounting screws (4) in adaptor plate holes.

(2) Captain DME Indicator

(a) Procedure is identical with procedure described for First Officer DME indicator.

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2. B. (3).

(2) Connect electrical-ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) On panel 5-211 make certain that :

(a) On AFCS control unit, no mode is engaged, particularly VOR Mode.

(b) On Captain and First Officer VOR-ILS-DME control unit, function selector is placed in S/B position.

(b1) On Captain and First Officer DME indicators DME1 and DME2 windows display 4 dashes and a point.

(5) Adjust LH DASH INSTRUMENTS, panel 12-211 or RH DASH INSTRUMENTS, panel 5-212 potentiometer to obtain correct illumination of indicator face.

(6) Panel 5-211, on Captain VOR-ILS-DME control unit :

(a) Place function selector in DME position.

(b) By means of frequency selectors, select frequency of ground station.

(7) In DME1 window on indicators :

(a) Check that dashes and point are visible during interrogator search.

(b) On panel 1-211 and 1-212, adjust DIGITS potentiometer to obtain correct brightness of dashes.

(c) After some seconds, the dashes disappear and the ground station distance appears.

(8) Panel 5-211

(a) On Captain VOR-ILS-DME control unit :
- Place function selector in S/B position
- By means of frequency selectors, select a frequency different from ground station frequency. DME1 windows display 4 dashes and a point.

(b) On First Officer VOR-ILS-DME control unit :
- Place function selector in DME position.
- By means of frequency selectors, select frequency of ground station.

(9) In DME2 window on indicators :

(a) Check that dashes are visible during interrogator search.

(b) After some seconds, dashes disappear and the ground station distance appears.

(10) Panel 5-211, on First Officer VOR-ILS-DME control unit :

(a) Place function selector in S/B position.

(b) Select a frequency different from ground station frequency DME2 windows display 4 dashes and a point.

G. Close-Up

(1) On panels 1-211 and 1-212, place DIGITS potentiometer in OFF position.

(2) On side panels 12-211 and 5-212 place LH and RH DASH INSTRUMENTS potentiometers in OFF position.

(3) Switch off electronics rack ventilation system (Ref. 21-21-00).

(4) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

DME INTERROGATORS 1S1 & 2S1 - REMOVAL/INSTALLATION

1. General

DME interrogators 1S1 and 2S1 are installed on shelf 7-215.

2. Removal/Installation

As the DME interrogators are identical, removal/installation of DME1 interrogator 1S1 only will be described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Blanking Plate for Ventilation Outlet	

B. Prepare

(1) Remove panel DS from shelf 7-215.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
DME1 IND	2-213	1S	3	C 8
DME1 SUP		1S	4	E 7
DME2 IND	13-216	2S	3	B19
DME2 SUP		2S	4	G19

(3) On panel 5-211, make certain that S/B-DME-OVRD function selectors on Captain and First Officer VOR-ILS-DME control units are in S/B position.

C. Remove DME1 Interrogator

(1) Gain access to shelf 7-215.

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.D.(1).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.F.(1).

F. Test

(1) Carry out a DME1 (DME2) test in self-test mode (Ref. 34-51-00, Adjustment/Test, Operational Test.)

G. Close-Up

(1) Install panel DS on shelf 7-215.

END OF THIS SECTION

NEXT

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AIR TRAFFIC CONTROL (ATC) - MODE S - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

Further to the installation of the TCAS on Concorde it has been necessary to install two Mode S transponders.

The COLLINS TPR-720 ATC/Mode S transponder has the capability of operating with the TCAS interrogator as well as with ATCRBS (Air Traffic Control Radar Beacon System) interrogators.

Mode S capability permits sending and receiving messages via the interrogation/reply data link.

Combined with the TCAS transmitter-receiver, it permits the system to determine the direction of an aircraft within its protection volume from this aircraft's altitude.

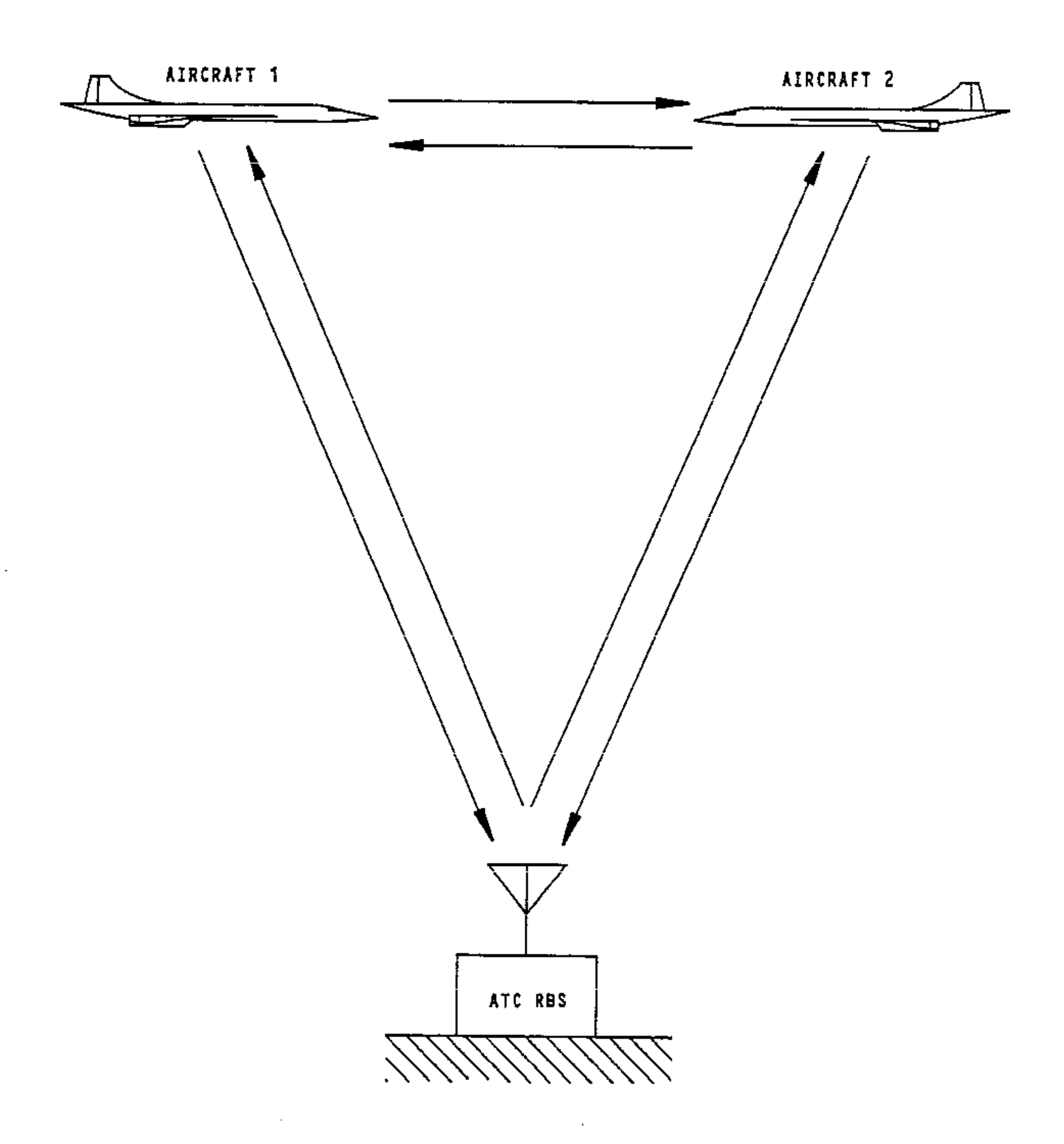
The system uses several replies from the replying aircraft to compute the altitude rate, range rate and distance to the other aircraft.

2. System Components and Location (Ref. Fig. 002)

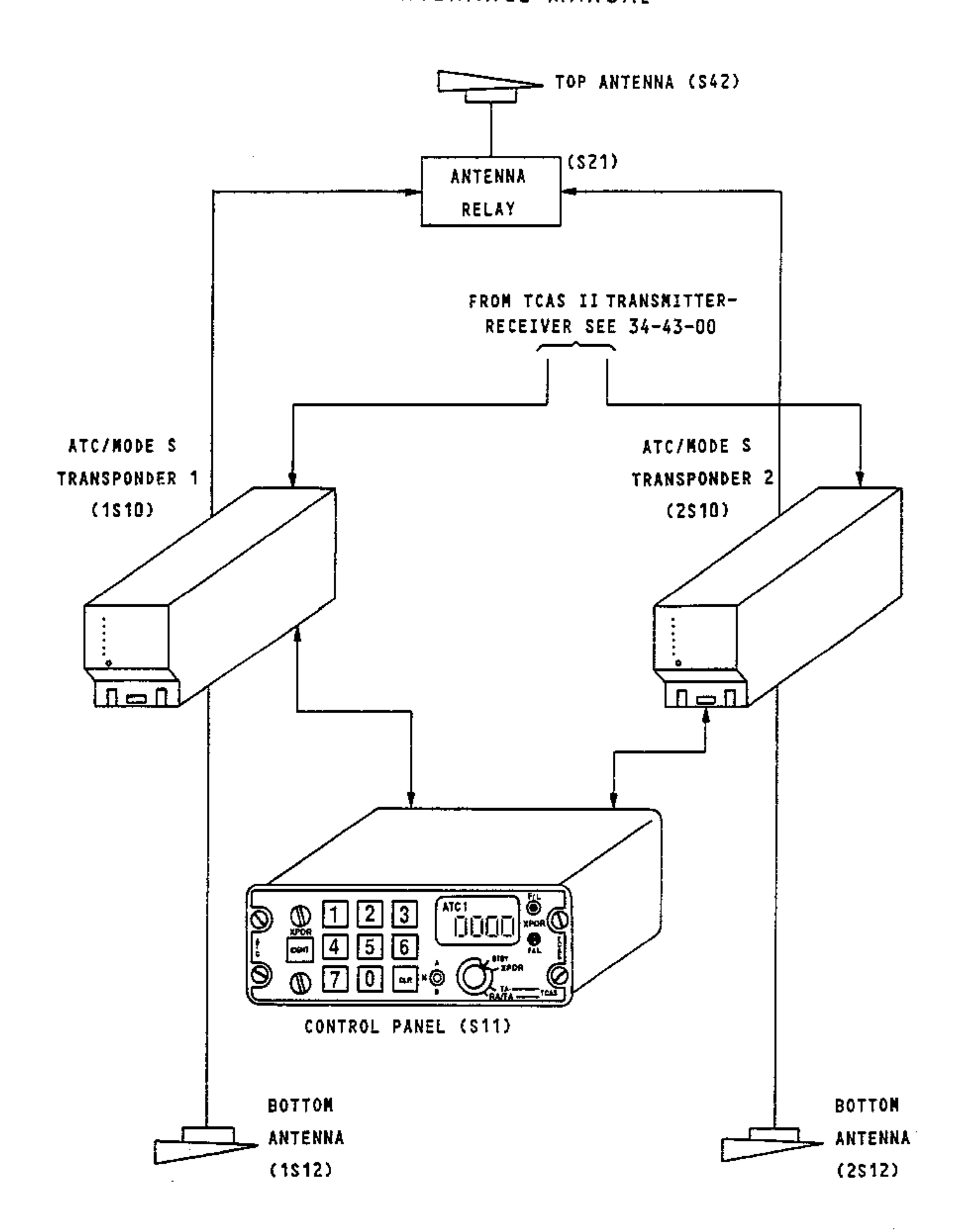
A. Components

The ATC Mode S system consists of :

- two COLLINS TPR-720 ATC/Mode S transponders (1S10, 2S10)
- one GABLES G6990 control panel (S11) common with the TCAS system (See 34-43-00)
- one antenna system consists of :
    - one top antenna (S42)
    - two STAREC1243-1 bottom antennas already existing (1S12, 2S12)
    - one antenna relay to switch between ATC1 and ATC2 (S21).



ATC/Mode S - Principle of Operation
Figure 001

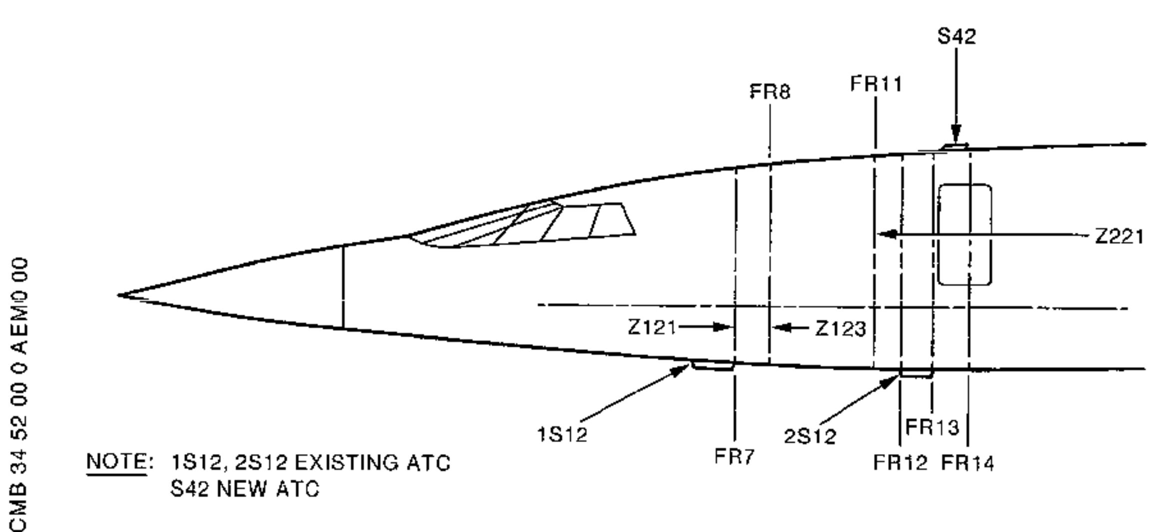


ATC/Mode S System Components
Figure 002

A. ATC/Mode S Component Location (Ref. Fig. 003, 004, 005, 006)

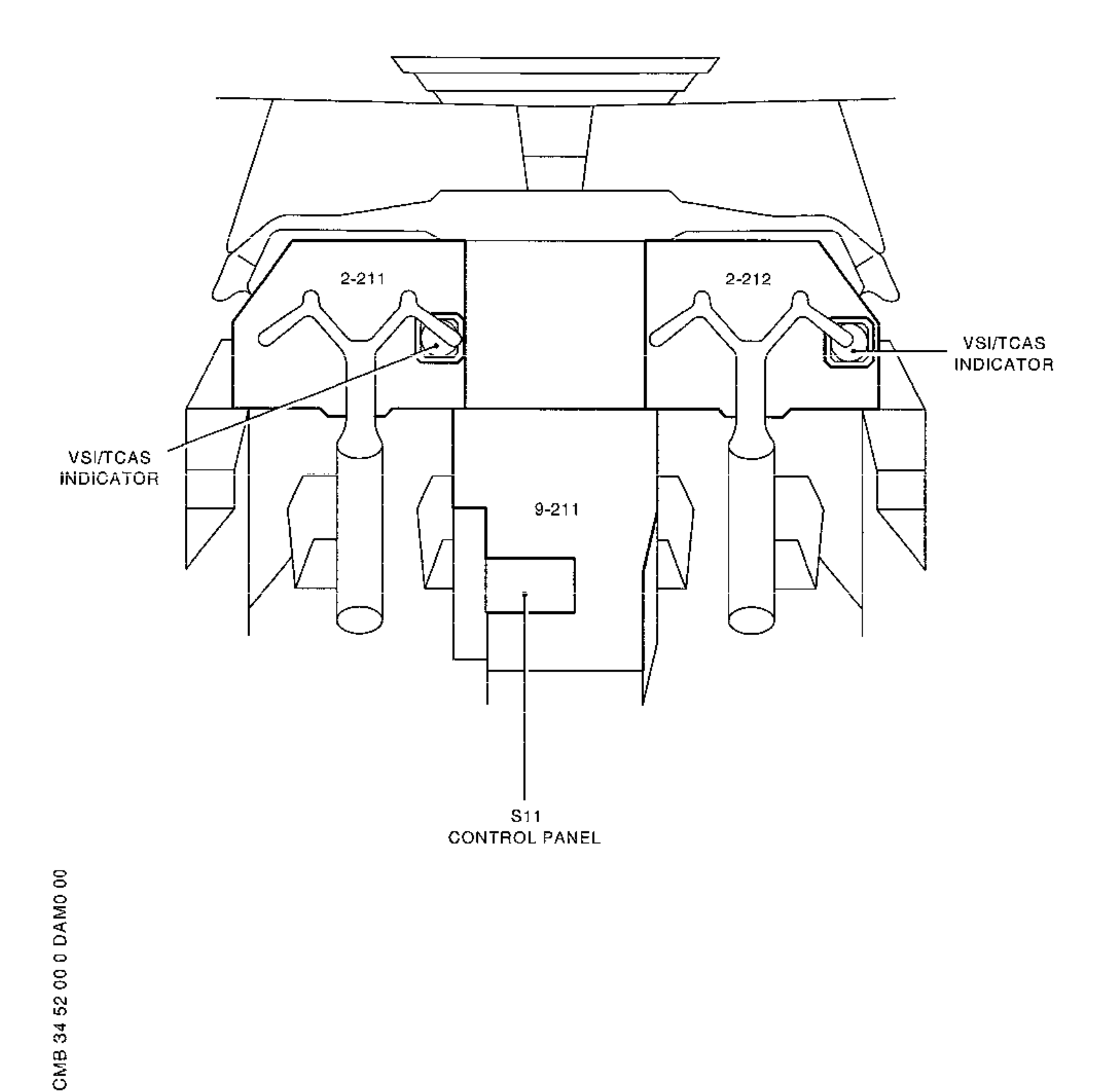
IDENT	FUNCTIONAL DESIGNATION	PANEL	ZONE
1S10	XPDR - ATC, 1	5	215
2S10	XPDR - ATC, 2	5	215
S11	CONTROL PANEL - ATC/TCAS	9	211
1S12	ANTENNA - ATC1, BOTTOM	FR6, FR7	121
2S12	ANTENNA - ATC2, BOTTOM	FR12, FR13	123
S42	ANTENNA - ATC 1 and 2, TOP	FR13, FR14	221
S21	RELAY - ANTENNA SWITCHING	5	215
S13	C/B - ATC1	2	213
S14	C/B - ATC2	13	216

ZONE215
2S10
1S10
S21
5-215
FR11
FR9
FR7
FORWARD



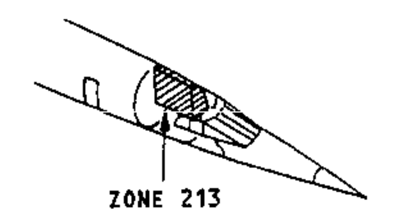
CMB 34 52 00 0 AEM0 00

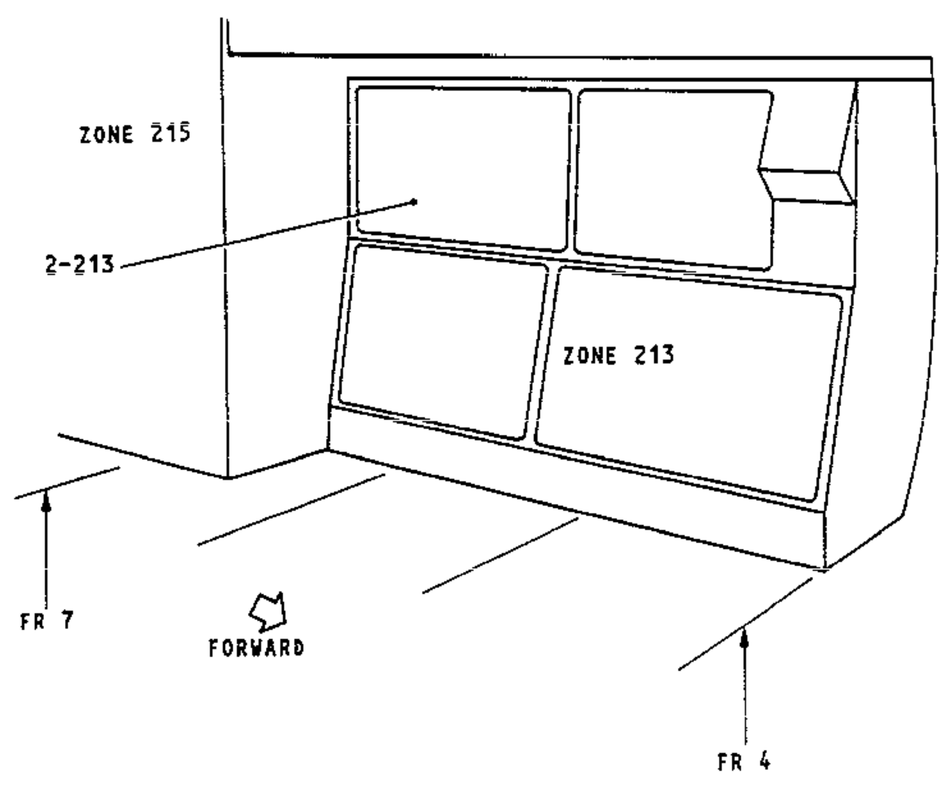
ATC/Mode S Component Location 1S10, 2S10, S21, 1S12, 2S12, S42
Figure 003



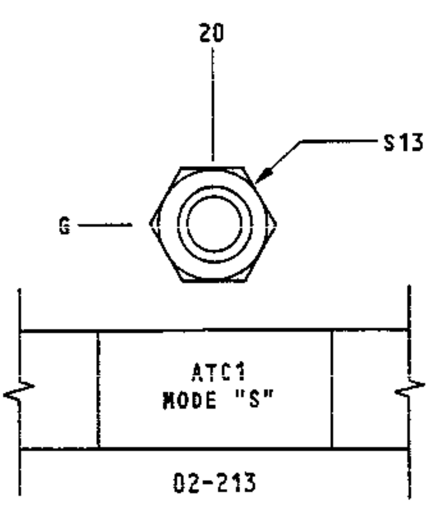
CMB 34 52 00 0 DAM0 00

ATC/Mode S - Component Location S11
Figure 004

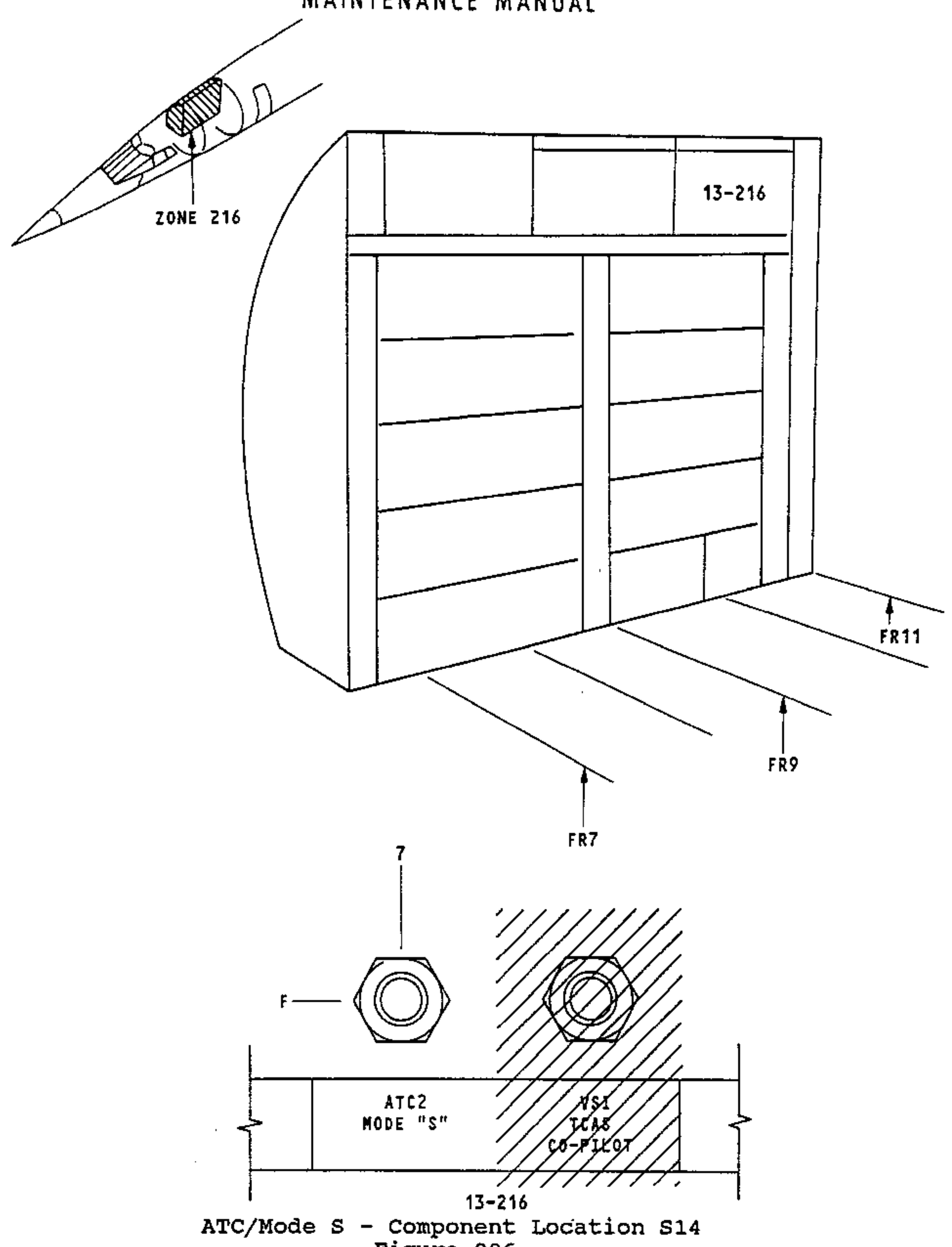




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ATC/Mode S Component Location S13
Figure 005



ATC/Mode S - Component Location S14
Figure 006

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COLLINS TPR-720 ATC/Mode S Transponder (1S10, 2S10)

A. Description

(1) Characteristics

(a) Physical

Size : 194 mm (h) x 128.5 mm (w) x 324.1 mm (d)
(7.6 x 5.1 x 12.8 in.)

Weight : 5.45 kg (12 lb), max.

Cooling : Convection

(b) Electrical

1 Receiver

Operating frequency : 1030 MHz
Intermediate frequency : 60 MHz

2 Transmitter

Operating frequency : 1090 MHz
Output power : 600 W

3 Power supply

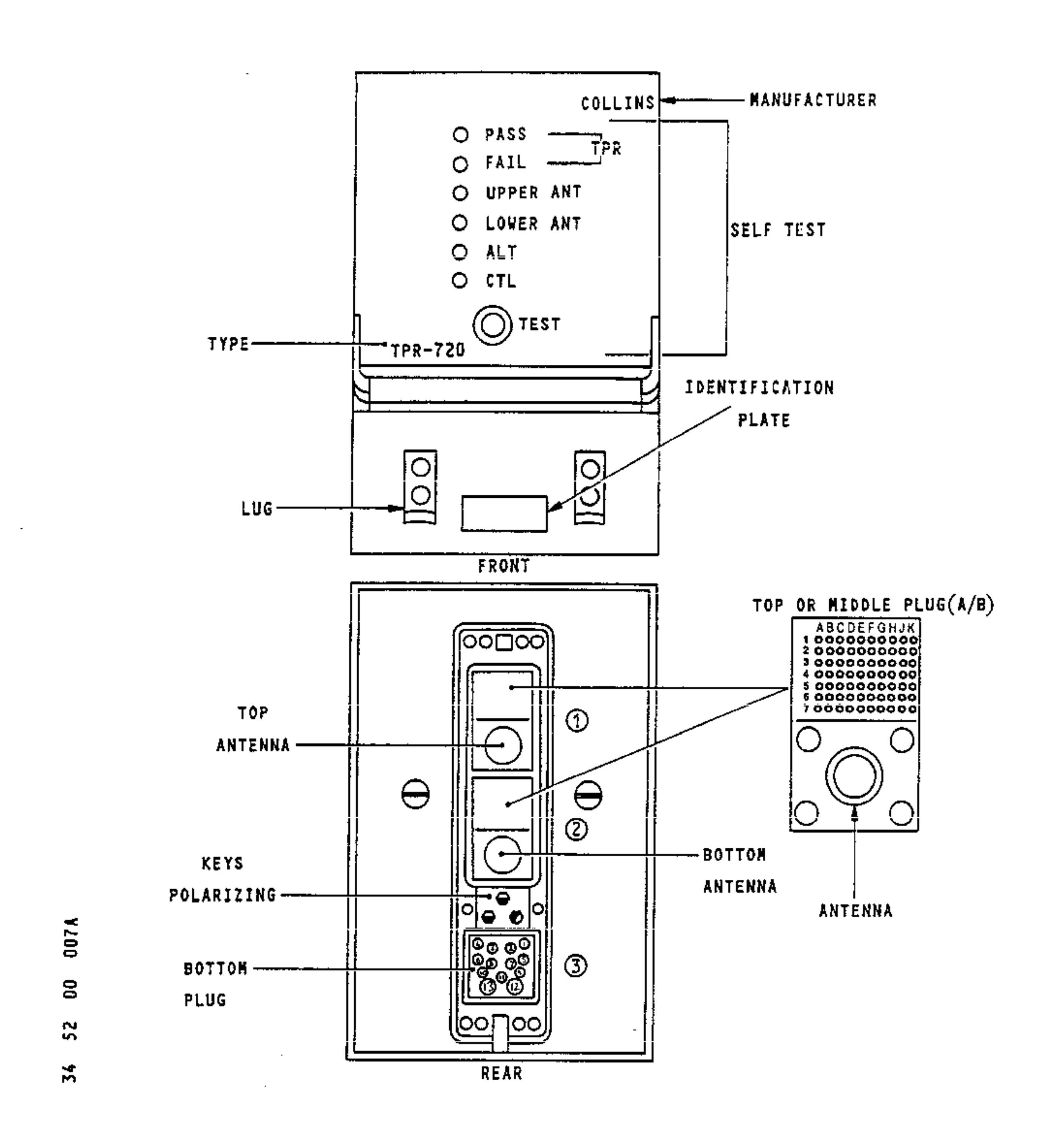
Primary - 115 V AC, 400 Hz, 42 W (nominal)
No interrogations
50 W (nominal), mode A
49 W (nominal), mode S
Power factor : 0.75 (Cos Ø)

(2) Detailed description (Ref. Fig. 007)

(a) The front of each ATC/Mode S transponder includes: (Ref. Fig. 007)

- two lugs
- one extraction and transport handle
- one identification plate
- Type of transponder (TPR-720)
- Manufacturer (COLLINS)
- TEST pushbutton and a set of indicator lights permitting the ATC/Mode S to be self-tested.

For the different functions of the TEST pushbutton and the indicator lights, refer to the table (Fig. 008).



Front & Rear View - TPR-720 ATC/Mode S
Figure 007

(b) The rear of each ATC/Mode S transponder includes two sets of plugs providing the electrical link between the transponder and its support (Ref. Fig. 007).

1 Top plug (A) including :

- An ITT CANNON 70-pin plug mainly used for :

- ALTIMETER 2 data
- AIR DATA 575 and 429

- An ITT CANNON coaxial plug for the link between the transponder and the top antenna circuit via the coaxial relay (S21).

2 Middle plug (B)

- An ITT CANNON 70-pin plug mainly used for :

- ALTIMETER 1 data
- AIR DATA 575 and 429

- An ITT CANNON coaxial plug for the link between ATC/Mode S and the bottom antenna :

  for ATC/Mode S transponder No. 1 (1S10) to Antenna S13

  for ATC/Mode S transponder No. 2 (2S10) to Antenna S14

3 Bottom plug

Mainly used for power supply of transponders (1S10 and 2S10). Each plug has 13 pins whose functions are:

- 115 V AC H power supply Pin 1
- Chassis ground Pin 11
- Suppression pulse Pins 12 and 13
- 115 V AC C Pin 7
- Signal ground Pin 8

NOTE : Between the middle plug and the bottom plug there are 3 polarizing keys preventing any equipment other than 1S10 or 2S10 from being connected.

CONTROLLER INDICATOR	ASSEMBLY CONCERNED	INDICATIONS PROVIDED ON THE INDICATORS
PASS		PASS : when illuminated indicates that the TPR-720 ATC/Mode S transponder has passed the test.
TPR	TPR concerns the ATC/MODE S transponder	
FAIL		FAIL : When illuminated indicates that the TPR-720 ATC/Mode S transponder has failed the test.
UPPER ANT	Upper antenna	UPPER ANT : when illuminated indicates that an anomaly has been detected in the upper antenna circuits.
LOWER ANT	Lower antenna	LOWER ANT : when illuminated indicates that an anomaly has been detected in the lower antenna circuits.
ALT	Altimeter data	ALT : when illuminated indicates that no altimeter information is received by the TPR.
CTL	Control Panel	CTL : when illuminated indicates an operating anomaly in the control panel circuits.
TEST	Pushbutton	Permits initiating self-test of TPR-720. Test signals exercise operation of TPR-720.

TPR-720 Controls and Indicators - Self Test
Figure 008

B. Operation

TPR-720 ATC/Mode S Transponder

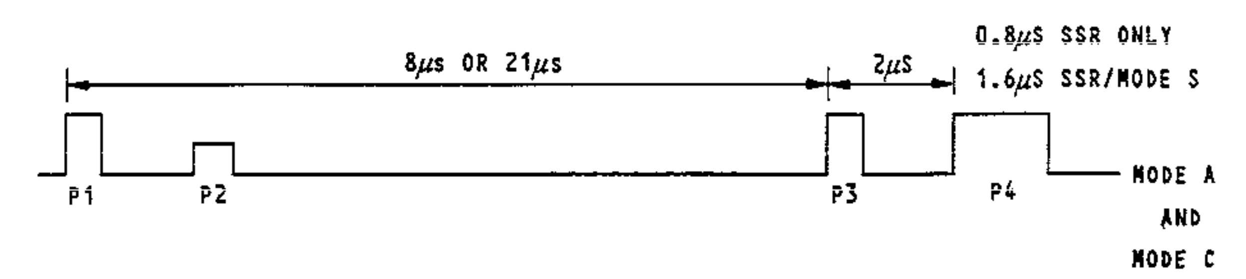
The TPR-720 transponder has the capability of operating with Mode S interrogators as well as standard ATCRBS interrogators. The Mode S capability permits sending and receiving messages via the interrogation/reply update link. The TPR-720 has five major functional circuits : transmitter, receiver, signal and message processor, CPU (Central Processing Unit) and I/O (Input/Output).

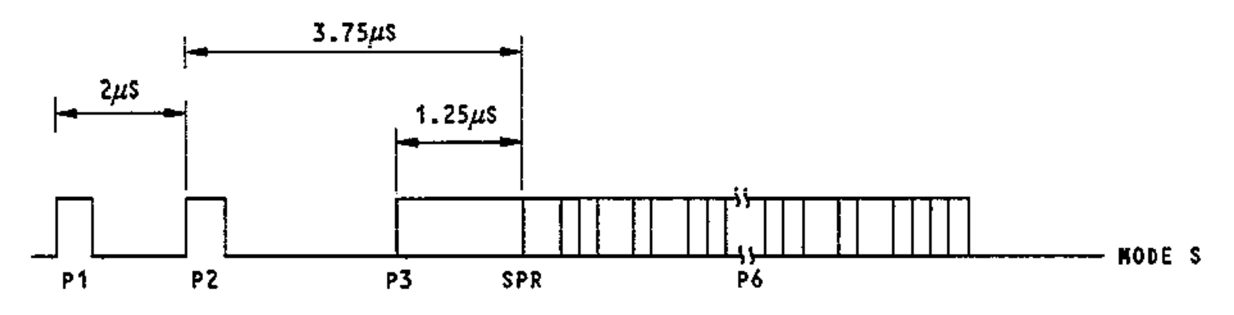
The 1030 MHz interrogation/data uplinks are applied from the L-band antennae to the receiver. In the receiver, the signal is mixed with a 1090 MHz output from the local oscillator to produce a 60 MHz IF. The IF signal is amplified, detected and passed on to the signal and message processor.

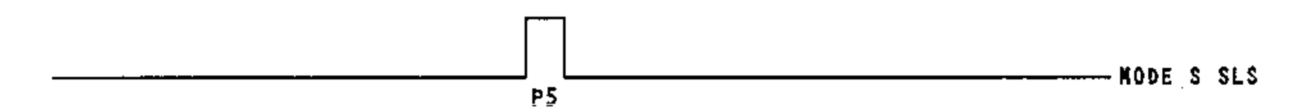
The processor decodes the interrogation to extract the message or interrogation-request data. The data is input to the CPU circuits. Here the data is further processed for output through the I/O circuits to applicable components. The I/O circuits provide the interface requirements between the CPU and the aircraft buses. The CPU circuits also receive data from various sources (altitude encoders, for example) for processing in preparation to transmit it.

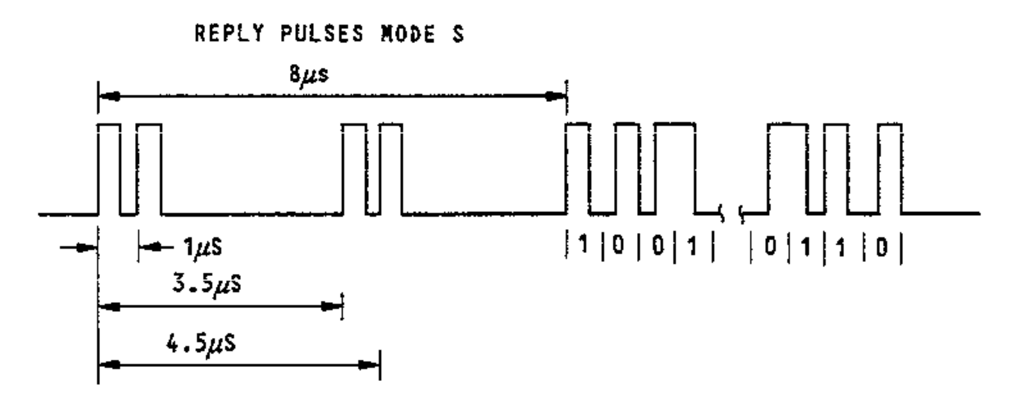
The modulator portion of the transmitter circuits receives the data, or reply, to be transmitted from the signal and message processor. The 1090 MHz local oscillator CW output is applied to switching diodes. As the modulator biases these diodes on and off, the resulting 1090 MHz output pulses are further amplified to a level of approximately 600 watts. The signal is then put out through the duplexer to the antenna for transmission. If in Mode C operation, the transponder reply will have added pulses which encode the aircraft altitude. If in Mode S, the added pulses may encode such as TCAS coordination data, TCAS output data or acknowledgment data.

Interrogation and Reply Pulses Mode S (Ref. Fig. 009).

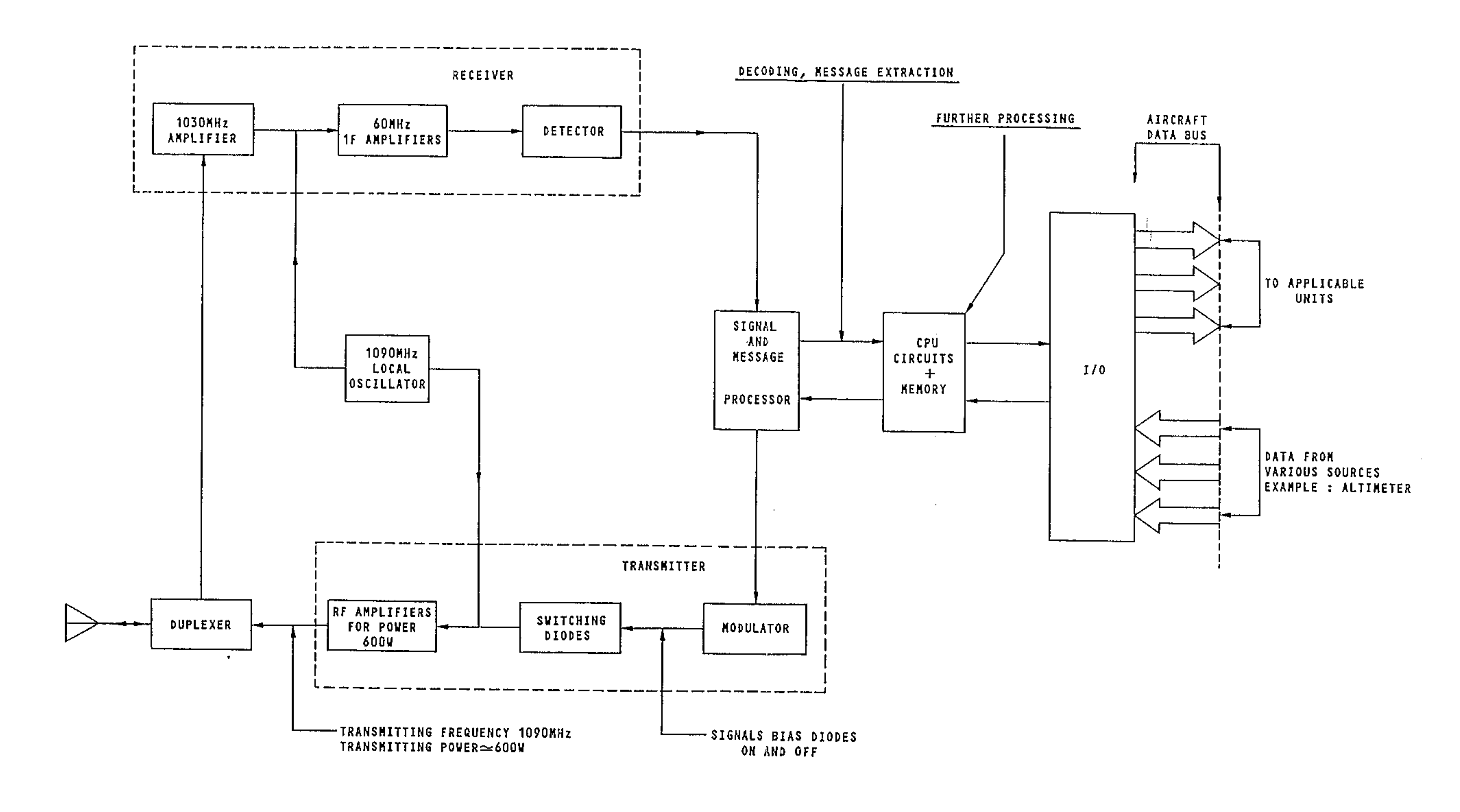




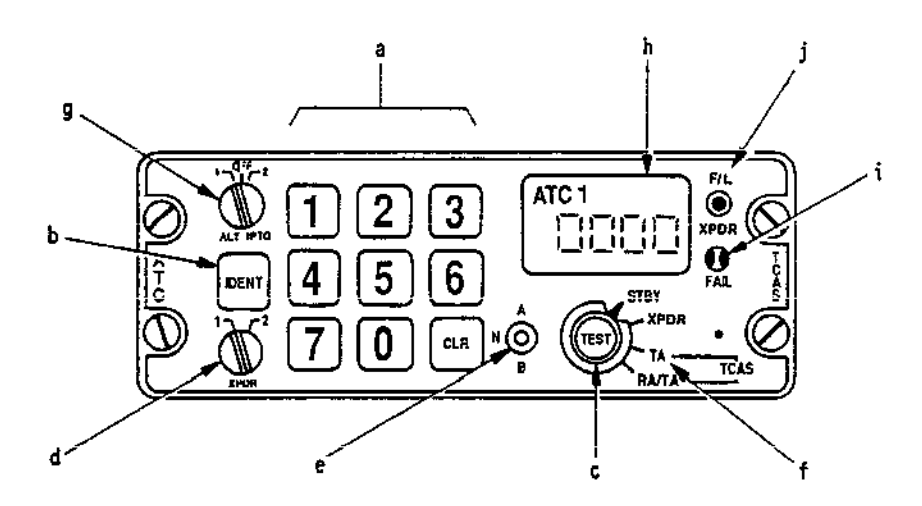


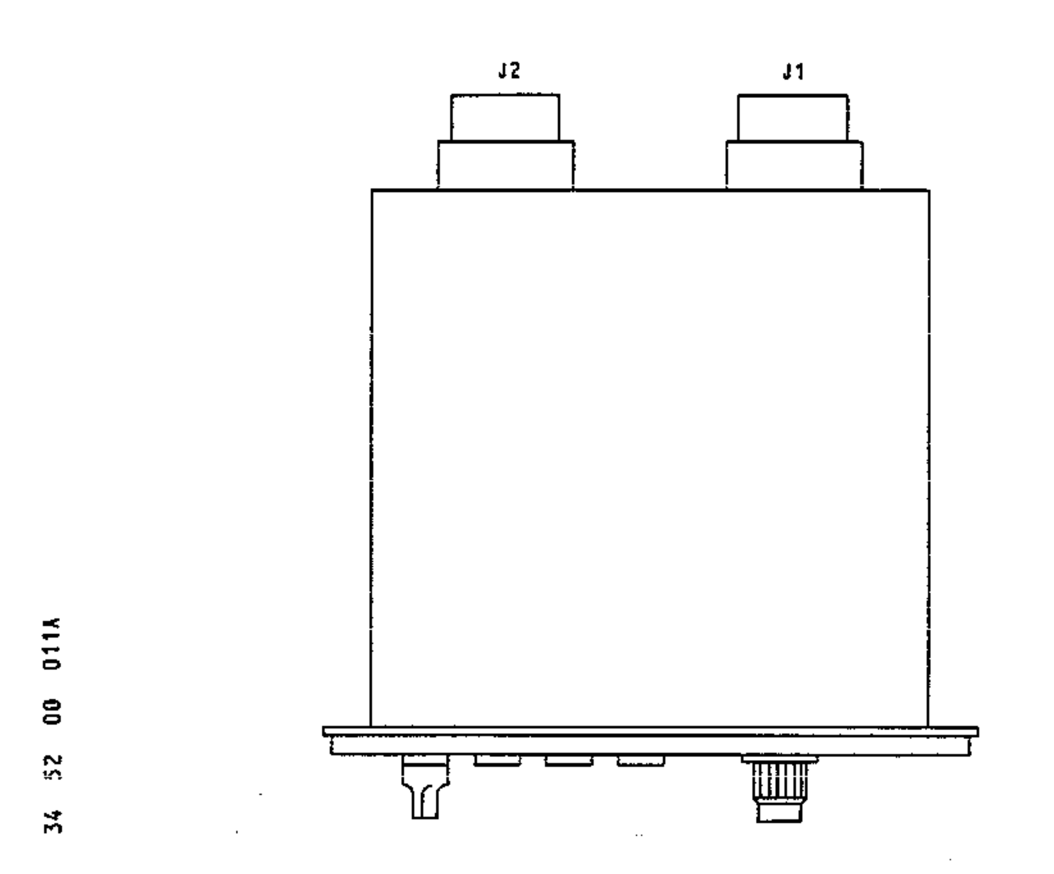


ATC/Mode S : Interrogation/Reply Pulses
Figure 009



ATC - Block Diagram
Figure 010





TCAS - Control Panel
Figure 011

A. Description (Ref. Fig. 011)

The GABLES G6990 Mode S control panel develops outputs used for controlling the functions of the two ATC/TCAS systems (for functions related to the TCAS refer to chapter 34-43-00).

It is rectangular, its size is 2.23 x 5.73 x 5.8 in. (56.6 x 145.5 x 147.3 mm) and its weight is 2.0 lb (0.83 kg).

(1) The front of the control panel (S11) groups the different functions necessary for operation of the ATC and the TCAS.

(a) ATC Code Selection Keys

Used for entering a new code and/or clear display code. Digit buttons allow a code entry of 0 thru 7 from left to right and are always active. The CLR button is used to clear the display or when pressed twice restores the previously active code. A blanked display or incomplete code (if not updated within approximately 3 seconds) will automatically be replaced by the previously active code. The old code will continue to be transmitted until the new code has been completely entered. A newly selected ATC code will be transmitted approximately 5 seconds after selection.

(b) IDENT Switch

Initiates the identification mode of operation for as long as the switch is held down (or a maximum of five seconds). The displayed ATC code is immediately transmitted when pressed.

(c) TEST Switch

When activated, the TEST switch initiates the self test mode of the control panel and sets bits 31 and 30 in all transmitted 429 words to "functional test".

(d) XPDR 1-2 Switch

Selects which transponder will be active. Places one ATC transponder in Standby and the other in ON mode, so that the two transponders are never simultaneously in ON mode. This switch also internally controls input to the LCD display.

(e) ABOVE-NORMAL-BELOW Switch

Sets the altitude range in which the TCAS display will show traffic. The control panel will use the

defaults of A = 2700 ft. and B = 7000 ft. (used in 429 word, label 015). "NORMAL" positon is -A to +A ; "ABOVE" position is -A to +B ; "BELOW" position is -B and +A.

(f) STBY - XPDR - TA - RA/TA Switch

Select between the four modes of system operation:

1 STBY position is standby mode for both control modules and transponders.

2 XPDR position

The selected transponder is operating.

3 TA only position is TCAS operation with TA only, no RA.

4 RA/TA position is TCAS normal operation with TA and RA.

(g) ALT RPTG 1-OFF-2 switch

Position 1 selects altitude reporting on transponder 1, OFF disables altitude reporting on both transponders and Position 2 selects altitude reporting on transponder 2.

(h) ATC Transponder Code Display

The single four digit LCD display is common to both modules and displays the code to which the transponder is set; it also contains several annunciators. The "ATC" annunciator is active at all times. The "1" annunciator is active whenever SYSTEM 1 module is selected or during a lamp test. The "2" annunciator is active whenever SYSTEM 2 module is selected or during a lamp test. Fault indications are also displayed. After a successful functional test, "PASS" will show on the display or if a malfunction was detected, an "F" followed by a numeric code will be displayed. During normal operation, if a test running in the background has detected a failure, an "F" followed by the presently active code will be displayed.

(i) XPDR FAIL Indicator

Illuminates whenever the "XPDR FAIL ... 1" or "XPDR FAIL ... 2" rear connector discrete is activated, or during a functional (for approximately 3 seconds) or lamp test.

(j) F/L switch

When depressed the barometric altitude of intruder aircraft is displayed on VSI/TCAS indicators.

(2) Rear panel

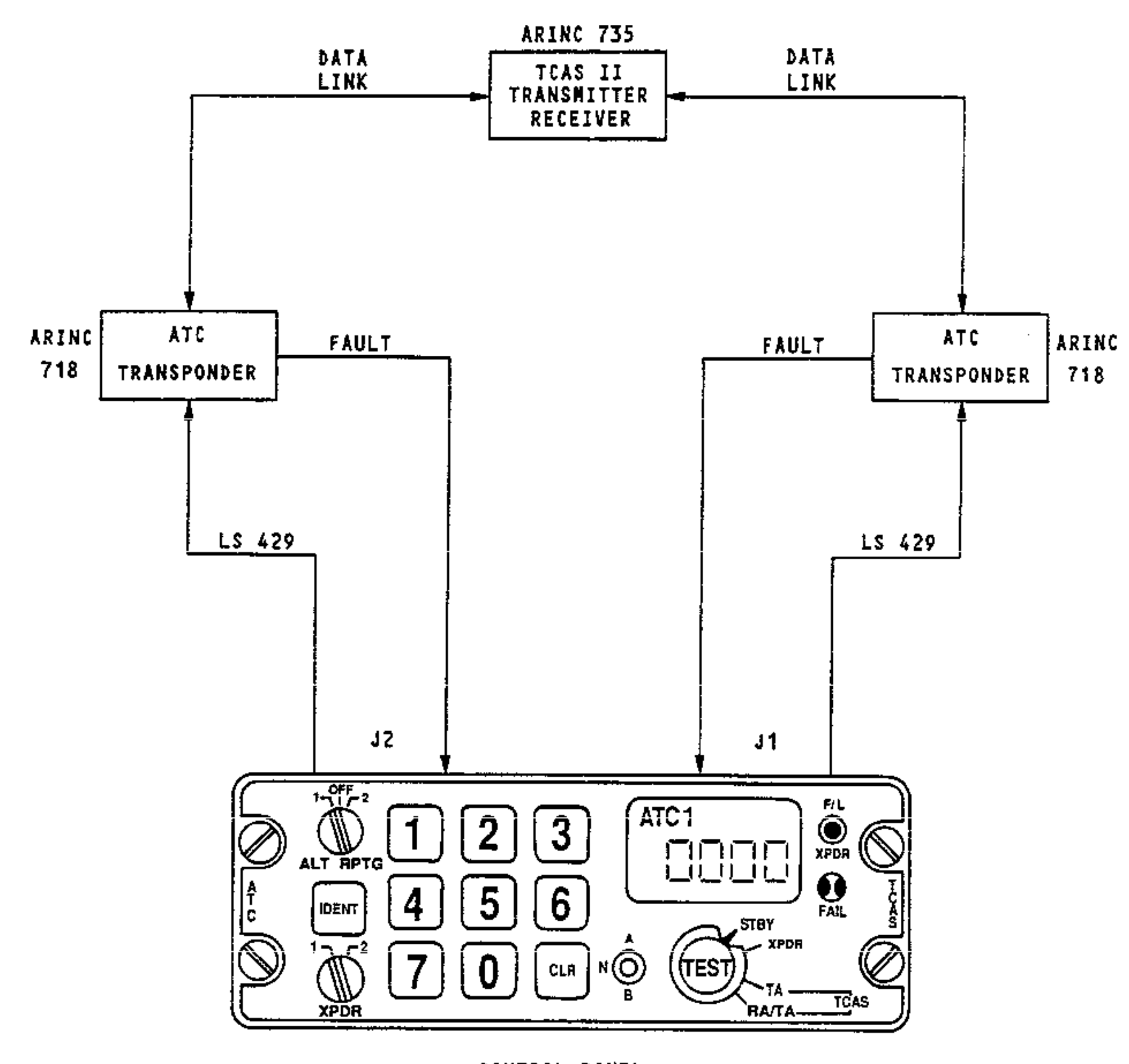
The rear of the control panel groups connectors J1 and J2 for connecting the panel to the ATC transponders. (Ref. Fig. 011).

There is also an identification plate and a modifications plate indicating the modifications applied to the panel.

B. Operation (Ref. Fig. 012)

The GABLES G6990 control panel is common to the ATC and TCAS functions and is connected as indicated in Figure 012 to connectors J1 or J2. The data is transmitted directly to the ATC 1 or 2 transponders according to the position of the XPDR 1/2 switch via LS 429.

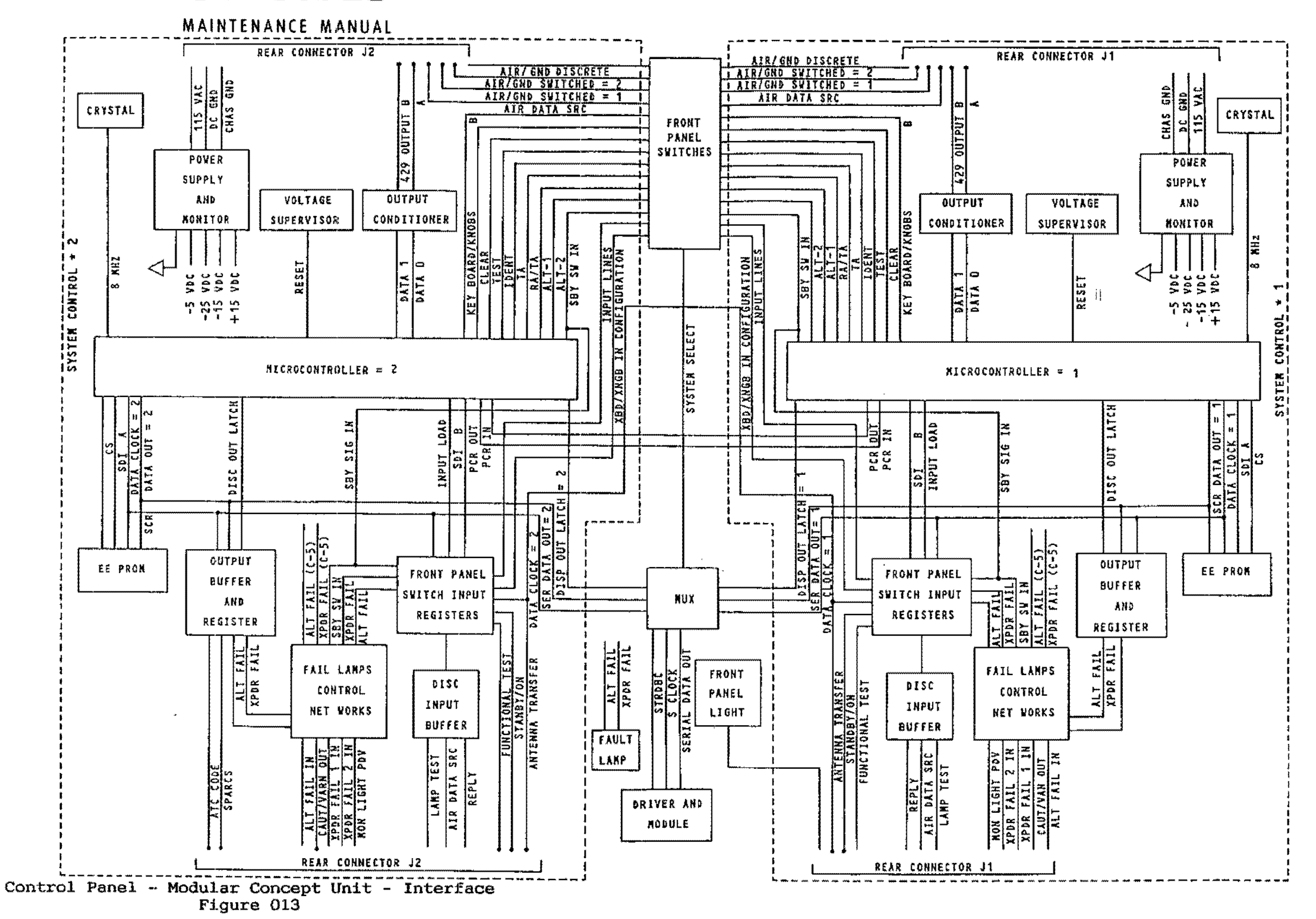
The data is transmitted from XPDR 1 or 2 to the TCAS transmitter-receiver. A fault detection circuit links the control panel to transponders 1 and 2. The control panel contains 2 independent assemblies (MCU, power supply) permitting control of the two ATC transponders (1S10, 2S10). One transponder is operational whilst the other is in standby but continues to receive the data transmitted to the transponders every 150 ms (Ref. Fig. 013).



TCAS - Interconnections - TCAS Control Panel
Figure 012

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Control Panel - Modular Concept Unit - Interface
Figure 013

34 52 00 013A

5. ATC Mode S Antennae

The ATC Mode S system consists of three antennae :

- two bottom antennae, 1S12, 2S12, one per transponder 1S10, 2S10 (already existing)
- one top antenna S42 installed for use in ATC Mode S with the TCAS (34-43-00).

A. Description

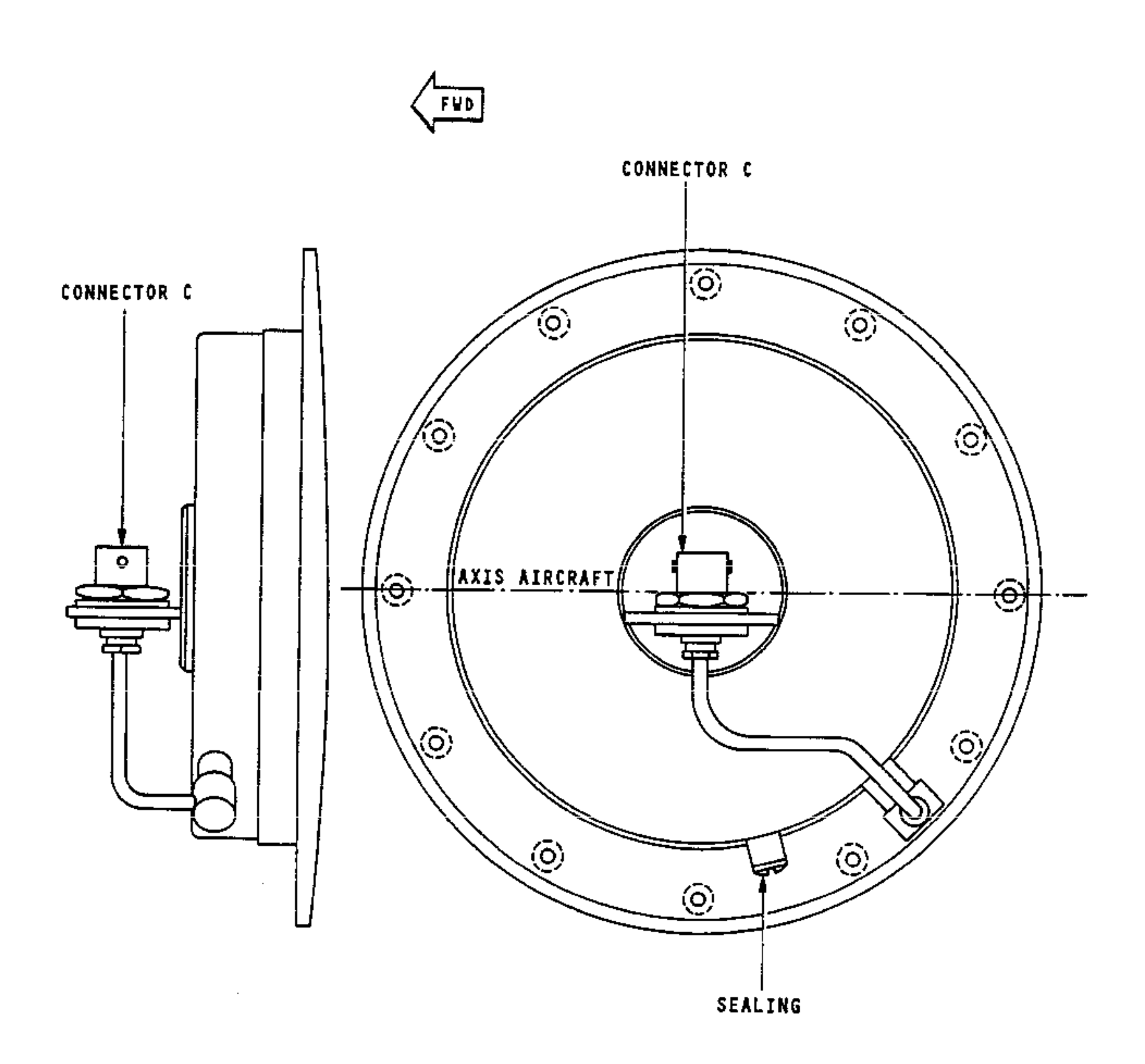
R R The top STAREC Type 1243-1 antenna (Ref. Fig. 014) and the bottom STAREC Type 292 antennae are similar.

B. Operation

In ATC Mode S operation, with the XPDR switch on control panel S11 at 1, antennae 1S12 (bottom antenna) and S42 (top antenna) are active and the antenna switching relay S21 is not energized.

In TCAS operation, with the XPDR switch on the control panel S11 at 2, the switching relay is energized.

Antennae 2S12 (bottom antenna of transponder 2, 2S10) and S42 (top antenna) are active.



ATC Antenna - STAREC 1243-1
Figure 014

6. Antenna Switching Relay S21 (Ref. Fig. 015)

A. Description

The antenna switching relay S21 is a type 402-175-5 relay manufactured by DOWKEY.

It is contained in a rectangular case with overall dimensions of 3.69 x 3.40 x 1.20 in. (93.73 x 86.36 x 30.48 mm)

(1) The front panel has three coaxial connectors

(a) (2) NC connector identified 1 connected to System 1 (1S10)

(b) (3) IN connector identified C connected to the top antenna (S42)

(c) (4) NO connector identified 2 connected to System 2 (2S10).

(2) On the side there is a 6 pin connector (1)

(a) Terminals A and B 115 V AC power supply

(b) Logic terminal C

(c) Terminals F, E, D not used.

(3) On the top

Equipment identification plate.

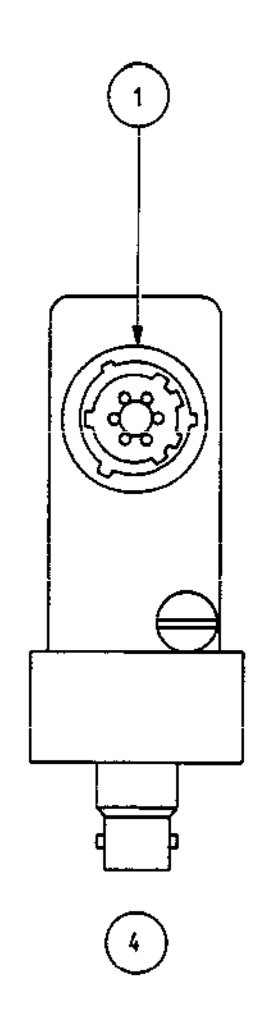
B. Operation (Ref. Fig. 016)

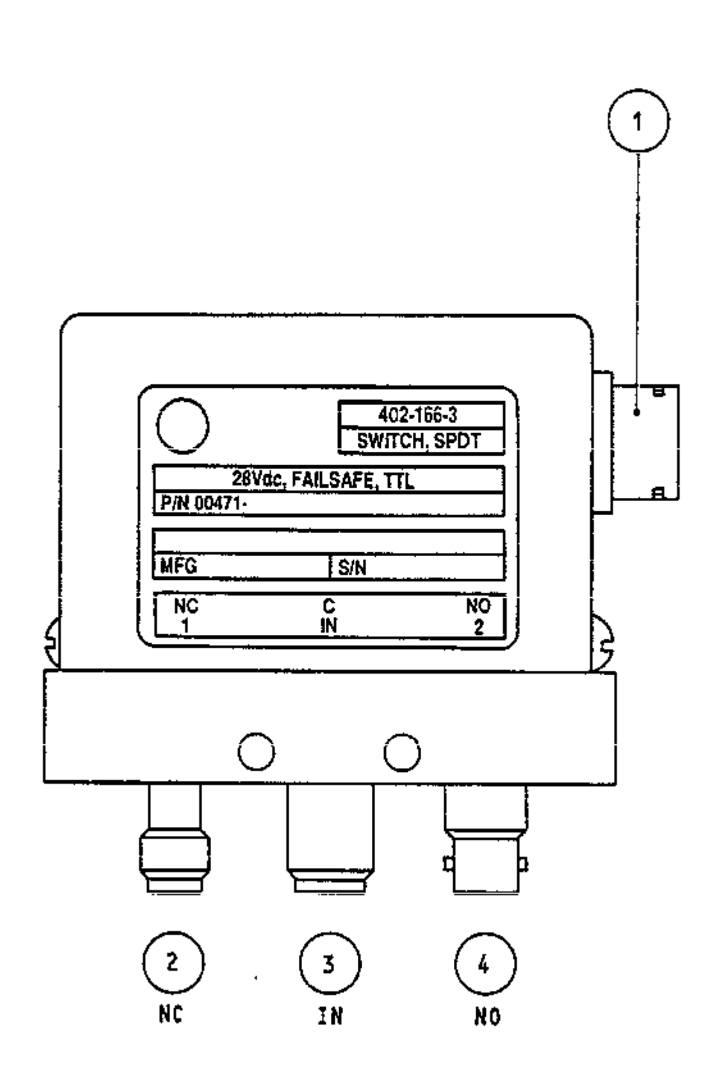
- With transponder No.1 (1S10) in operation :

  Relay S21 is not energized, antennae 1S12 (bottom) and S42 are active.

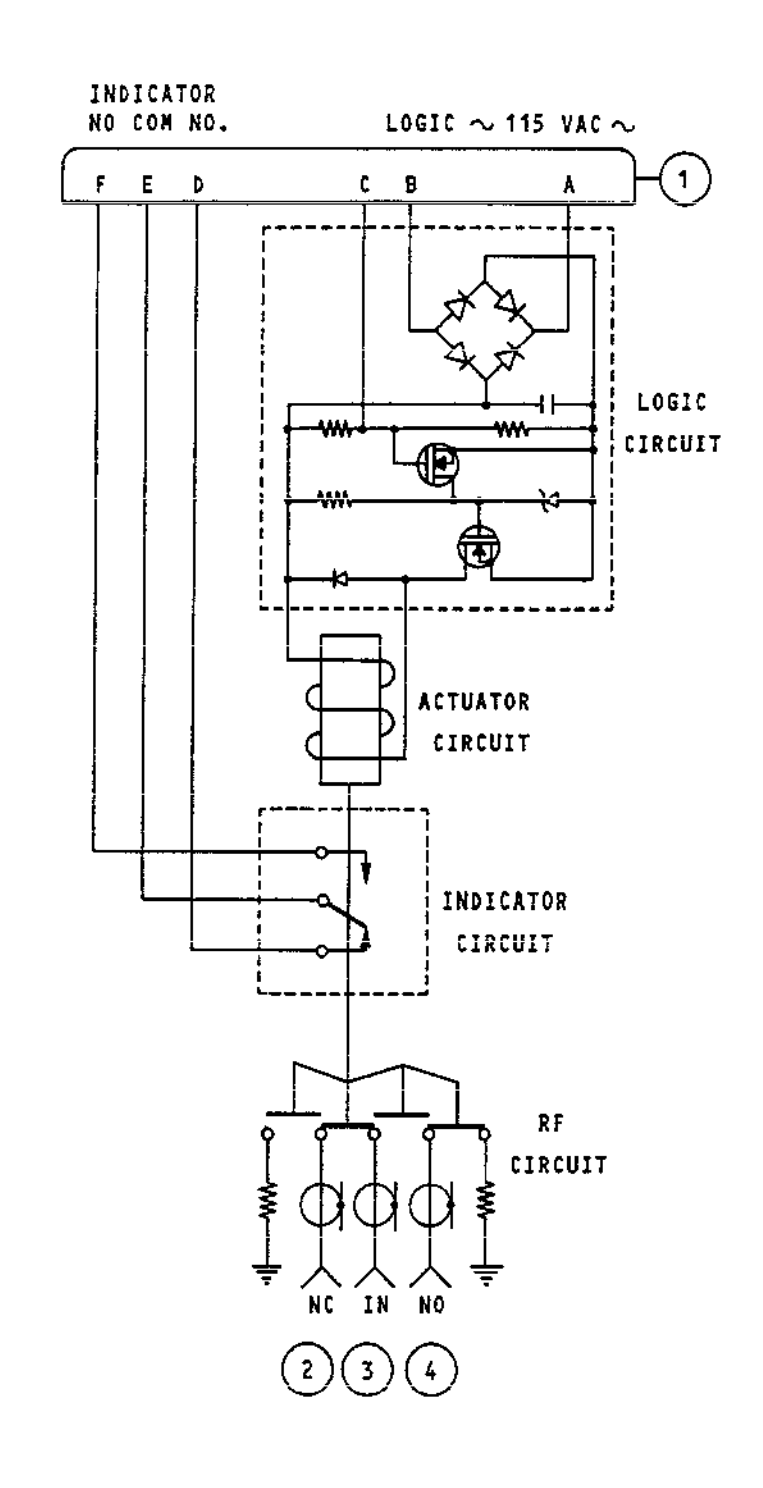
- With transponder No.2 (2S10) in operation :

  Relay S21 is supplied with 115 V AC from busbar 3X via C/B S14 ATC Mode S (System 2) on one hand and by SYS1, SYS2 switching on control panel S11 on the other hand. In these conditions, antennae 2S12 (SYS2 bottom antennae) and antenna S42 (top antenna) are active (WDM 34-52-11 and 34-52-21).





ATC Antenna Switching Relay
Figure 015



ATC - Antenna Switching Relay - Schematic
Figure 016

AIR TRAFFIC CONTROL MODE S (ATC) - TROUBLE SHOOTING

CAUTION : OBSERVE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The Table provides information, including component location, required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

As the ATC1 Mode S and ATC2 Mode S systems are identical, trouble shooting procedure is described for system 1. For system 2 trouble shooting, refer to electrical identifiers and numbers in parentheses.

2. Prepare

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
ATC Ground TEST Unit (ATC601 1FR)	
One simulator - Pressure Sensors or Pressure Generator	PN87209455
One Boomset	From TE2037000
One Ground Service Microphone/ Headset for Service Interphone	From TE2037000

B. ATC1 (ATC2) trouble shooting can be carried out in a hangar if the antennae are clear of all obstacles and aircraft is on the ground, landing gear shock absorbers compressed.

C. On ADC control unit on centre console 9-211, make certain that ADC1 and ADC2 ON-OFF switches are in OFF position and TEST selector switches are in NORM position.

D. On ATC control panel, on centre console 9-211, place XPDR1-2 switch in 1(2) position.
Place test STBY - XPDR - TA - RA/TA selector switch in STBY position.

E. Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

F. Switch on electronics rack ventilation system (Ref. 21-21-00).

G. Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No. 1 INPH SUP	1-213	R 89	K19
1ST PLT AUDIO SELECTOR SUP		R 241	L21
LH U/C WEIGHT SW "A" SYS SUP		G 292	M17
ADC1 28V SUP		1F 74	P12
ADC1 26 V SUP	2-213	1F 78	A 2
1ST PLT ALT ASI STBY IND		1F 88	B 1
2ND PLT ALT ASI STBY IND		2F 88	B 2
1ST PLT ADC INST SUP		1F 75	B 3
ADC1 115V SUP		1F 73	F 3
ATC1 MODE S		S 13	G20
FLT CONT & NAV BUS 14XS		X 355	H 2
RH U/C WEIGHT SW "B" SYS SUP	3-213	G 294	B 9
No. 2 INPH SUP		R 90	H 2
2ND PLT AUDIO SELECTOR SUP		R 242	H 3
ADC2 28V SUP	5-213	2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
ATC2 MODE S		S 14	F 7
ADC2 26V SUP		2F 78	F14
ADC2 115V SUP		2F 73	F15
NAV INST BUS 13X		X 345	G 4
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8

H. Trip the following circuit breaker :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STICK SHAKER SUP	1-213	W 513	P15

I. On jack panel, LH side console 1-211 (RH side console 1-212) :

- connect boomset to BOOM connector
- place MIC SELECT OXY-BOOM switch in BOOM position.

J. Connect the ground service telephone to service interphone jack R76, zone 124, or R95, zone 123.

K. Switch on interphone and connect service interphone jack to crew interphone system (Ref. 23-41-00, Adjustment/Test).

L. On altimeters on Captain and First Officer instrument panels check that mode selector knob is positioned so as to leave letter N visible, then select barometric pressure of 1013.2 mb.

NOTE : For altitude corrections to apply during use of pressure generator or pressure sensor simulator, refer to Chapter 34-11-00, Servicing.

Trouble Shooting

```
**************************************************************
*Check lighting of the front face of the ATC Mode S           *
*[1] control panel with SW L383 of the LIGHTING CENTRE        *
*CONSOLE PANEL.  Front face lighting must vary.  IF           *
**************************************************************
    ||      |                 +--------------------------------------+
    ||      |                 |No control panel illumination.        |
    OK      |---NOT OK--------|Ref. Chart 101                        |
    ||      |                 +--------------------------------------+
**************************************************************
*Perform ATC test on control panel [1].  Place selector       *
*switch in STBY position :                                    *
*- Place XPDR selector at 1 then 2.                           *
*- Press TEST pushbutton.                                     *
*If the functional test is OK, PASS is displayed.             *
**************************************************************
    ||      |                 +--------------------------------------+
    ||      |                 |FAIL is displayed automatically.      |
    OK      |---NOT OK--------|Ref. Chart 102                        |
    ||      |                 +--------------------------------------+
    ||      |                 +--------------------------------------+
    ||      |                 |Replace control unit.                 |
    ||      |                 +--------------------------------------+
**************************************************************
*On the front face of each transponder [3], [4], in           *
*zone 5-215, perform the functional test.                     *
*Press the TEST pushbutton.                                   *
*The PASS indicator comes on green.                           *
**************************************************************
    ||      |                 +--------------------------------------+
    ||      |                 |The FAIL indicator comes on red.      |
    OK      |---NOT OK--------|Ref. Chart 103                        |
    ||      |                 +--------------------------------------+
```

```
       ||       |
   ***********************************************************
RB *If XPDR FAIL light on the control panel comes on, either  *
RB *Transponder No.2 system has failed or the antenna relay   *
RB *has failed to switch.  If the relay has failed to switch, *
RB *the Transponder No.2 front panel LEDs will indicate Top   *
RB *Antenna fail (this LED could show failure of the top      *
RB *antenna, the antenna relay failing to switch or an        *
RB *open/bad VSWR in the cable from No.2 transponder to the   *
RB *relay).  A resistance check between the inner and outer of*
RB *Transponder No.2 top antenna coax connector will show     *
RB *whether the antenna has failed.  A resistance of 50 ohms  *
RB *will be measured when the control panel is selected to    *
RB *Transponder No.1 (due to the dummy load in the relay)     *
RB *and a resistance of about 1 ohm will be measured if the   *
RB *relay has switched correctly and there is no problem with *
RB *the coax cable from Transponder No.2 to the relay.        *
RB *                                                          *
RB *NOTE:  It has been observed that the relay fail-to-switch *
RB *       condition sometimes only manifests itself after a  *
RB *       period of energisation.  Thus allow the ATC        *
RB *       circuits to be active for more than 10 mins. prior *
RB *       to conducting the tests above.                     *
   *                                                          *
   *Check operation of the antenna relay:                     *
   *- with the XPDR switch on the control unit in position 1  *
   *  the relay is not energized : ATC1 works with [7] and    *
   *  [9]                                                     *
   *- with the XPDR switch on the control unit in position 2  *
   *  the relay works with [8] and [9]                        *
   *Relay switching is OK.                                    *
   ***********************************************************
      ||      |                  ---------------------------------
      OK      |____NOT OK_______| Replace antenna relay [10].     |
      ||                         ---------------------------------
   ***********************************************************
   *Check antennae [7], [9] for ATC Mode S [3] for System 1.  *
   *Check antennae [8], [9] for ATC Mode S [4] for System 2.  *
   ***********************************************************
      ||
      OK
      ||
   ***********************************************************
   *Replace faulty antenna.                                   *
   ***********************************************************
      ||
      OK
      ||
   ***********************************************************
   *Check wiring.  Ref. WDM 34-52-00.                         *
   ***********************************************************
```

```
*************************************
* NO ILLUMINATION OF CONTROL PANEL *
*************************************
```

```
        ----------------------------------------------------
        |MEASURE 115 V AC AT OUTPUT OF CIRCUIT BREAKER [2] |
        ----------------------------------------------------
                || 
           115 V AC                                OK
                ||        --------------------------------------------
                ||        |Check voltage at input of circuit breaker.|
                ||        --------------------------------------------
                ||                 0V                  115 V AC
---------------------------   ----------------   ------------------
|Ref. Circuit WDM 33-17-04|   | Ref. AC DIST |   |Replace circuit |
|(INST LTG CONSOLES CENTRE)|  |   24-51-14   |   | breaker [2].   |
---------------------------   ----------------   ------------------
```

Chart 101

```
******************************************
* IN THE WINDOW OF THE CONTROL UNIT [1], *
* FAIL IS DISPLAYED, A FAULT IS DETECTED.*
******************************************
```

To determine the type of control unit [1] fault :
- de-energize the unit
- put the functional test discrete to ground
- restore electrical power
- FXX (fault code) appears in the display window.

- Fault code - See table

FUNCTIONAL TEST DISPLAY	CONDITION INDICATED	BIT	CODE "F"
PASS	No fault detected. User must check display operation.		
F01	EPROM (electrically programmable read-only memory) check sum fault detected.	X	X
F02	RAM (random access memory) fault detected.	X	X
F04	Hardware internal clocks faulty.		
F08	Inter-processor communication fault.	X	
F10	EEPROM (electrically erasable read-only memory) fault. All locations are probably incorrect.	X	X
F20	Difference of configuration between control cards	X	X

To exit this mode :

Press any key on the control unit.

NOTE : If several faults occur at the same time, the fault code displayed represents the sum of all the fault codes present. Code F08 is only displayed when the functional test is initiated from the rear connector.

Chart 102

****
* ON ONE OF THE TRANSPONDERS [3], [4], THE FAIL INDICATOR LIGHT *
* COMES ON RED. THIS MEANS THAT A FAULT IS DETECTED ON AN ATC OR A *
* PERIPHERAL CIRCUIT *
****

Faults detected during a self-test are indicated in Table C below.

INDICATOR/ CONTROL	FUNCTION
PASS	The PASS indicator (green light) will light whenever the BITE self-test is successful.
FAIL	The FAIL indicator (red light) will light whenever the BITE self-test detects a failure.
UPPER ANT	The UPPER ANT indicator (red light) will light during the self-test whenever the impedance of the upper antenna does not meet specification.
LOWER ANT	The LOWER ANT indicator (red light) will light during the self-test whenever the impedance of the lower antenna does not meet specification.
ALT	The ALT indicator (red light) will light whenever the altitude input sources indicates a failure of the barometric altitude input (wrong format), or if the internal receiver has failed.
CTL	The CTL indicators will light whenever the altitude input source indicates a failure of the control input (wrong format), or if the internal receiver has failed.
TEST	The TEST pushbutton indicates a self-test check of the unit. During self-test (initiated by the TEST pushbutton or after initial power on), the transponder BITE performs 10 functions. These functions are: 1. All normal processing stops. 2. Check sum of ROM contents. 3. RAM test performed. 4. Noise sources, within each receiver, are stimulated and the results are monitored. 5. Antenna integrity is checked. 6. A simulated ATCRBS/MODE S All-Call is injected into the top and bottom receivers consecutively. 7. Following transmission, the transmitter monitor is sampled, and the reply is verified to be correct. 8. Power supply monitor is sampled. 9. A serial test checks all serial buses (maintenance, TCAS, COMM A/B, COMM C/D). 10. The unit returns to normal operation.

Chart 103, 1/2

INDICATOR/ CONTROL	FUNCTION
TEST (suite)	All indicators lamps will be lit, for a 1 second period, following the indication of the self-test function. During the remainder of the period (that the self-test pushbutton is depressed and 10 seconds after it is released), the lamps associated with the self-test results will be lit. Afterwards, all lamps will remain off until the next self-test is initiated. For the period after all indicators lamps are lit, the front panel indicator lamps will light for the following reasons : 1. LRU failures cause red LRU indicator to light (All detected failures are considered a LRU failure except detected antenna failures). 2. No failures, green PASS indicator lights. 3. Antenna failures cause top and/or bottom antenna failure indicators to light. The maintenance portion of the non-volatile memory is updated.

Chart 103, 2/2

ITEM NO. AND DESCRIPTION		ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC		MANUAL REF. WIRING DIAGRAM
[1]	Control panel - ATC Mode S		9-211	S11	FLT CPT	34-52-13	R/I	34-52-01
[2]	Circuit breaker CTR CONSOLE INST LTS SUP		14-216	L405	B8	24-50-00	R/I	33-17-04
[3]	Trans-ponder 1	door DS	5-215	1S10	Electronics rack LH	34-52-33	R/I	34-52-01
[4]	Trans-ponder 2	door DS	5-215	2S10	Electronics rack LH	34-52-33	R/I	34-52-01
[5]	Circuit breaker ATC1 Mode S		2-213	S13	G20	24-50-00	R/I	34-52-01
[6]	Circuit breaker ATC2 Mode S		13-216	S14	F7	24-50-00	R/I	34-52-01
[7]	Antenna - ATC Mode S No. 1		Zones 121/ 122	1S12	between FR6 and FR7	34-52-11	R/I	34-52-01
[8]	Antenna - ATC Mode S No. 2		Zones 123/ 124	2S12	between FR12 and FR13	34-52-11	R/I	34-52-01
[9]	Antenna ATC/TCAS		Zones 221/ 222	S42	between FR13 and FR14	34-52-11	R/I	34-52-01
[10]	Antenna relay		5-215	S21	Electronics rack LH	34-52-43	R/I	34-52-01

Component Identification
Table 101

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AIR TRAFFIC CONTROL MODE S (ATC) - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) With aircraft in ground configuration, landing gear shock absorbers compressed.

(2) On ADC control panel on centre console 9-211, make certain that ADC1 and ADC2 ON-OFF switches are in OFF position and test selectors in NORM position.

(3) On ATC control panel on centre console 9-211 make certain that:

Selector - STBY - XPDR - TA - RA/TA is in STBY position.

(4) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(5) Switch on electronics rack ventilation system (Ref. 21-21-00).

(6) Make certain that the following circuit breakers are closed:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 MODE S	2-213	S 13	G20
ATC2 MODE S	13-216	S 14	F 7
CTR CONSOLE INST LTS SUP	14-216	L405	B 8

C. Tests

NOTE: As the two ATC Mode S systems are similar, only system 1 test will be described, for system 2 refer to identifiers in parentheses.

(1) Lighting Check.

(a) On panel 4-211, adjust LIGHTING CENTRE CONSOLE PANEL selector and check that ATC control panel lighting varies.

(b) Adjust selector to obtain normal illumination.

(2) ATC1 Mode S (ATC2 Mode S) check using self-test facility.

(a) On centre console 9-211, on ATC control panel place:

1 XPDR1-2 switch in 1 (2) position.

2 Selector STBY - XPDR - TA - RA/TA in STBY position.

3 ALT RPTG switch in position 1.

(b) Ensure that the ATC fail light on the ATC/TCAS control panel is OFF.

(c) Push and release the test switch on the ATC/TCAS control panel and ensure that the following sequence occurs:

1 The ATC fail light on the control panel illuminates for approx. 3 secs.

2 Observe on the front panel of the selected transponder, the following sequence:

a All LED's illuminate for approx. 1 sec.

b All LED's go off momentarily.

c The green "pass" LED illuminates for approx. 10 secs. A successful test will show PASS on the panel display.

NOTE 1: It is also possible to test individual transponders via the test button, adjacent to the indicator LEDs on the front of each unit.

NOTE 2: When standby (STBY) is selected there are no transponder transmissions. When XPDR is selected and the aircraft is on the ground, Mode A and C transmissions are inhibited. Mode S is not inhibited
RB on the ground but the test set will
RB show Mode S "fail".

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(3) Dual ATC System Test.

(a) Select XPDR from STBY position.

(b) Set XPDR switch on the ATC/TCAS control panel to "1".

1 Open ATC 1 Circuit Breaker (G20) on panel 2-213.

2 Check XPDR FAIL lamp (AMBER) on the ATC/TCAS control panel is illuminated.

(c) Set XPDR switch on the ATC/TCAS control panel to "2".

1 Check XPDR FAIL lamp (AMBER) is extinguished.

(d) Reset ATC 1 Circuit Breaker (G20) and open ATC 2 Circuit Breaker (F7).

(e) Check that XPDR FAIL lamp (AMBER) is illuminated.

(f) Set XPDR switch on the ATC/TCAS Control Panel to "1".

1 Check XPDR FAIL lamp (AMBER) is extinguished.

(g) Reset ATC 2 Circuit Breaker (F7).

D. Close-Up

(1) On centre console 9-211, on ATC control panel:

Selector STBY - XPDR - TA - RA/TA is in STBY position.

(2) Reset circuit breaker tripped in para. 1.C.(3)(a).

(3) On panel 4-211, place LIGHTING CENTRE CONSOLE PANEL selector in OFF position.

(4) Switch off electronics rack ventilation system (Ref. 21-21-00).

(5) Switch off electrical ground power unit and de-energize the aircraft electrical network (Ref. 24-41-00, Servicing).

2. Functional Test

A. Equipment and Materials

	DESCRIPTION	PART NO.
RB	Electrical Ground Power Unit	-
RB	ATC VSWR Tester	QB8M
RB	VSWR Adapter Cable from KIT4-99224	119KW-01
RB	ATC Ramp Test Set	IFR 601 ATC
	Bonding Meter	-
	Boomset	From TE 2037000
	Ground Service Telephone with Headset for Service Interphone	From TE 2037000
RB	Antenna Shield Material	ECCOSORBAN79

B. Prepare

(1) The system test can be carried out inside a hangar if antennae are free of all obstacles and if aircraft is on the ground with shock absorbers compressed.

(2) On ADC control panel, on centre console 9-211, make certain that ADC1 and ADC2 ON-OFF switches are in OFF position and test selectors are in NORM position.

(3) On ATC Mode S control panel, on centre console 9-211, make certain that:

(a) STBY - XPDR - TA - RA/TA selector is in STBY position.

(4) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(5) Switch on electronics rack ventilation system (Ref. 21-21-00).

(6) Make certain that the following circuit breakers are set:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No. 1 INPH SUP	1-213	R 89	K19
1ST PLT AUDIO SELECTOR SUP		R241	L21
LH U/C WEIGHT SW "A" SYS SUP		G292	M17
ADC1 28 V SUP		1F 74	P12
ADC2 26 V SUP	2-213	1F 78	A 2
1ST PLT ALT ASI STBY IND		1F 88	B 1
2ND PLT ALT ASI STBY IND		2F 88	B 2
1ST PLT ADC INST SUP		1F 75	B 3
ADC1 115V SUP		1F 73	F 3
ATC1 MODE S		S 13	G20
FLT CONT & NAV BUS 14XS		X355	H 2
RH U/C WEIGHT SW "B" SYS SUP	3-213	G294	B 9
No. 2 INPH SUP		R 90	H 2
2ND PLT AUDIO SELECTOR SUP		R242	H 3
ADC2 28 V SUP	5-213	2F 74	F12
2ND PLT ADC INST SUP	13-216	2F 75	A14
ATC2 MODE S		S 14	F 7
ADC2 26 V SUP		2F 78	F14
ADC2 115 V SUP		2F 73	F15
NAV INST BUS 13X		X345	G 4
CTR CONSOLE INST LTS SUP	14-216	L405	B 8

(7) Trip the following circuit breaker:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STICK SHAKER SUP	1-213	W513	P15

(8) On jack panel on LH side console (1-211) (RH side console (1-212)):

(a) Connect boomset to BOOM jack.

(b) Place MIC SELECT OXY-BOOM switch in BOOM position.

(9) On ground service jack R76 (Zone 124), R95 (Zone 123) connect ground service headset.

(10) Switch on interphone system and establish connection between ground and flight compartment interphone system (Ref. 23-41-00, Adjustment/Test).

(11) On Captin and First Officer instrument panels make certain that altimeter selector knobs are in N position, then select barometric pressure of 1013.2 mb.

C. Ground Operational Test

RB (1) Check the bonding of ATC antennae.

(a) Make successively a connection between each bonding point of the antenna 1S12-2S12-S42 (fixing bolt) and the structure.

(b) The resistance difference shall not exceed 5 milliohms at any point.

RB (2) SWR (Standing Wave Ratio) check of ATC1 (ATC2) system.

(a) Centre console 9-211 on ATC control panel:

1 Place mode selector in STBY position.

(b) Trip the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 SUP	2-213	S 13	G20
ATC2 SUP	13-216	S 14	F 7

(c) Make certain that panel ES215 on LH electronics rack is removed.

(d) On shelf 7-215, remove ATC1 (ATC2) transponder to gain access to coaxial connector 1S10AA (2S10AA).

(e) After calibrating the ATC VSWR tester at 1030MHz, connect the ATC/TCAS ARINC 600 adapter cable from KIT4-99224 to the bridge network of the tester. Attach the SMA-to-N type adapter to the free end of the cable and then connect the tester 2:1 load to the free N-type end. Calibrate the meter to read 2:1 and then remove the load. Finally, connect the ARINC 600 connector to the free SMA end of the cable.

(f) Connect SWR meter coaxial cable to BCX 1 of connector 1S10AA (2S10AA) to measure the bottom antenna SWR.

(g) Measure and note SWR value (antenna and coaxial cable) for the following frequencies:
1030 MHz:

SWR must be better than 2:1.

(h) Measure the SWR of the top antenna and coaxial cable on ATC1 transponder by inserting the SWR meter coaxial cable in to the top coaxial socket ACX1 on 1S10AA (2S10AA). SWR must be better than 2:1.

(i) To measure the SWR of the top antenna from ATC2 transponder, the coaxial relay must be switched first.

1) Reset the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 SUP	2-213	S 13	G20
ATC2 SUP	13-216	S 14	F 7

2) On the ATC control panel switch XPDR switch from 1 to 2.

3) Insert the SWR meter coaxial cable into the top coaxial socket ACX1 on 2S10AA. SWR must be better than 2.1.

RB (j) Switch the XPDR switch from 2 to 1 and repeat items (e), (f), (g) and (h) for 1090MHz.

RB (k) Switch the XPDR switch from 1 to 2 and measure the SWR of the top antenna from ATC2 transponder coaxial socket ACX1.

RB (l) On the control panel select XPDR 1 and trip the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 SUP	2-213	S 13	G20
ATC2 SUP	13-216	S 14	F 7

RB (m) On shelf 7-215, disconnect SWR meter from coaxial connector 1S10AA (2S10AA) and install ATC1 (ATC2) transponder on its mounting.

RB (n) Reset the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 SUP	2-213	S 13	G20
ATC2 SUP	13-216	S 14	F 7

RB (3) Prepare for the System Test.

(a) Position the ATC ramp test set for the No. 1 top antenna. Mask No. 1 and No. 2 bottom antennae using ECCSORBAN79 antenna shield material.

(b) Switch ON the test set and press the SET UP key to enter set up menu. Insert the range and height parameters for the antenna in use and select top or bottom as appropriate. Use SELECT keys to move cursor to parameter required and SLEW keys to change the selected parameter. (Ref. SET UP in Operation Guide). Select any key to EXIT set up menu.

(c) Carry out the ATC System Operational Test (para. 1.C.).

(d) Set the function switch on the ATC/TCAS control panel to XPDR.

(e) Set the ALT RPTG switch on the ATC/TCAS control panel to 1.

(f) Set XPDR No. 1.

CAUTION: BEFORE CIRCUIT BREAKERS (G295 AND G293) ARE OPENED PLACE "EMERGENCY GENERATOR ISOLATE CONTROL SWITCH" X219, ZONE 6-214 TO ISOLATE.

(4) Trip the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH U/C WEIGHT SW "A" SYS SUP	1-213	G295	M18
LH U/C WEIGHT SW "B" SYS SUP	3-213	G293	B 8

(5) System Test - ATC No. 1 System (Top Antenna).

(a) Ensure ATC ramp test set is switched ON and ensure that it passes Self Test after pressing SELF TEST and RUN keys. (Ref. ATC 601 Operator Guide).

(b) Depress AUTOTEST and RUN keys on the ATC ramp test set and verify the following is displayed on the test set screen.

1 Auto Test passed Modes A, C and S.

2 The Reply Frequency is 1090 ± 1.0 MHz.

3 The Effective Radiated Power (ERP) is about 57dbm.

4 The Minimum Trigger Level (MTL) is -74 ± 3.0dbm.

NOTE: If AUTOTEST FAILED is displayed on the test set after the above test, use the SELECT keys to page through the tests to determine the failure. The SELECT keys are also used to select the relevant individual tests described below.

NOTE: Individual Tests - Mode S Uplink Format UF16 may show failed. Mode S UF20 and UF21 will also show fail as these are Comm A Uplinks which are not fully defined at this time. These failure items do not, therefore, constitute a failure for the AUTOTEST.

(c) Using the SELECT keys on the ATC 601 test set, cycle through to the individual MODES ALL CALL TEST screen and press RUN.

1 Verify the Mode S Address is correct for the A/C under test in accordance with the following:

A/C REG	HEX CODE
G-BOAA	4004B5
G-BOAB	4004B6
G-BOAC	4004B4
G-BOAD	4004B7
G-BOAE	4004B8
G-BOAF	4004BA
G-BOAG	4004B9

(d) Select the individual ATCRBS REPLY TEST and press RUN. (Mode A test).

1 On the ATC/TCAS control panel select each of the following 4 digit codes and verify that the ATC ramp test set displays the correct corresponding codes.

1275
1661
1367
6731
0124
4720
4006
5225

NOTE: The control panel will only accept 4 digit inputs. The new code has to be inserted within 3 secs. The transponder is not updated until the code is accepted + 5 secs.

2 Press and release the IDNT Push Button on the ATC/TCAS control panel and ensure that the "ID" appears before displayed code on ATC ramp test set screen (ie ID5225) and remains displayed for 20 ± 5 secs.

(e) (Mode C Check). Set Captain's and First Officer's Altimeters Baro Set to 1013.2 mb (29.92 in) and:

1 Select XPDR on control panel.

2 Select No. 1 as altitude reporting source.

3 Simulate a barometric altitude of 10000 ft.

4 Verify that the ATC ramp test set displays 10000 ft.

5 Select altitude reporting to OFF and verify that Mode C replies are no longer received.

6 Repeat 1 to 5 with No. 2 as altitude reporting source.

NOTE: 10000 ft is chosen to avoid possible interference with other aircraft. If the ADC test set is being used to verify a range of altitudes less than 10000 ft the likelihood is high that TCAS equipped aircraft approaching the airport will see the transmissions and produce traffic alerts or resolution advisories. If such tests are to be conducted, then the Control Tower will need to be notified.

NOTE: That with No. 2 altitude source and No. 2 Transponder selected, the No. 1 Alt input is from ADC No. 2 and No. 2 Alt input is from ADC No. 1.

(6) System Test No. 2 ATC System - Top Antenna.

(a) On the ATC/TCAS Control Panel select the XPDR switch to 2.

RB (b) Carry out instructions in paras. 2.C.(5)(2) 1 thru 5.

(7) System Test - Bottom ATC Antenna Verification Checks.

(a) Remove antenna shields from both bottom antennae.

(b) Remove the ATC ramp test set from top antenna position and reposition for the bottom ATC antenna position. Either use antenna shield on appropriate top ATC antenna or position test set such that A/C provides a shield to top antenna. Perform test set SET UP accordingly.

(c) Ensure test set passes SELF TEST by pressing SELF TEST and RUN keys.

(d) Perform an AUTOTEST of selected system by pressing AUTOTEST and RUN keys and verify:

1 Auto Test passed Modes A, C and S.

2 Reply Frequency is 1090 ± 1.0 MHz.

3 The Effective Radiated Power (ERP) is about 54dbm.

4 The Minimum Trigger Level (MTL) is -74 ± 3.0dbm.

NOTE: If AUTO TEST FAILED is displayed on the test set after the above test, use the SELECT keys to cycle through the individual test screens to identify where the failure has occurred.

(e) On ATC/TCAS control panel, select XPDR switch to the other system.

RB (f) Repeat para.2.C.(7)(d) for alternate system.

(g) Select the XPDR switch on ATC/TCAS control panel to 1.

(h) Select the ALT RPTG switch on the ATC/TCAS control panel to 1.

(i) Select Function switch on ATC/TCAS control panel to STBY.

(8) Check by listening to local DME stations that simultaneous ATC1(2) and DME1(2) operation is successful.

(9) Finish the test by a self test of the ATC1(2) through the test pushbutton located on the front face of ATC/TCAS control panel.

(10) At the end of ATC1 and 2 test, ensure the systems are powered off.

D. Close-Up

(1) On ATC control panel place:

(a) Selector STBY - XPDR - TA - RA/TA in STBY position.

(2) On ADC control panel place:

(a) ADC1 (ADC2) ON-OFF switch in OFF position.

(3) Switch off ATC ramp test set (IFR ATC601) power.

(4) Switch off interphone system (Ref. 23-41-00, Adjustment/Test).

(5) On panel 4-211, place LIGHTING CENTRE CONSOLE PANEL selector in OFF position.

(6) On ADC1 front panel, shelf 6-215 (ADC2 front panel, shelf 6-216) remove pressure sensor simulator from TEST connector.

(7) Replace if necessary panels ES215 and ES216 on RH and LH electronics racks.

(8) On LH (1-211) (RH(1-212)) side console, disconnect boomset from jack panel.

(9) Disconnect ground service headset from ground service jack R76 (Zone 124) (R95 (Zone 123)).

RB (10) Trip the following circuit breakers:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X355	H 2
NAV INST BUS 13X	13-216	X345	G 4

(11) Switch of electronics rack ventilation system (Ref. 21-21-00).

(12) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00 Servicing).

AIR TRAFFIC CONTROL (ATC) MODE S ANTENNA - REMOVAL/INSTALLATION

1. General

Removal for replacement or check. The ATC1 Mode S system consists of antenna (1S12) between frames 6B and 7 (zone 121-122) and antenna (S42) between frames 13 and 14 (zone 221-222). The ATC2 Mode S system consists of antenna (2S12) between frames 12 and 13 (zone 123-124) and antenna (S42) between frames 13 and 14 (zone 221-222). Antennae 1S12 and 2S12 of the systems are identical.

2. ATC Mode S Antenna

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Sealant	PR 1436G

(*) Access platform, height of access 3.672 m (12 ft.)

(**) Access platform, height of access 6.670 m (21 ft. 11 in.)

B. Prepare

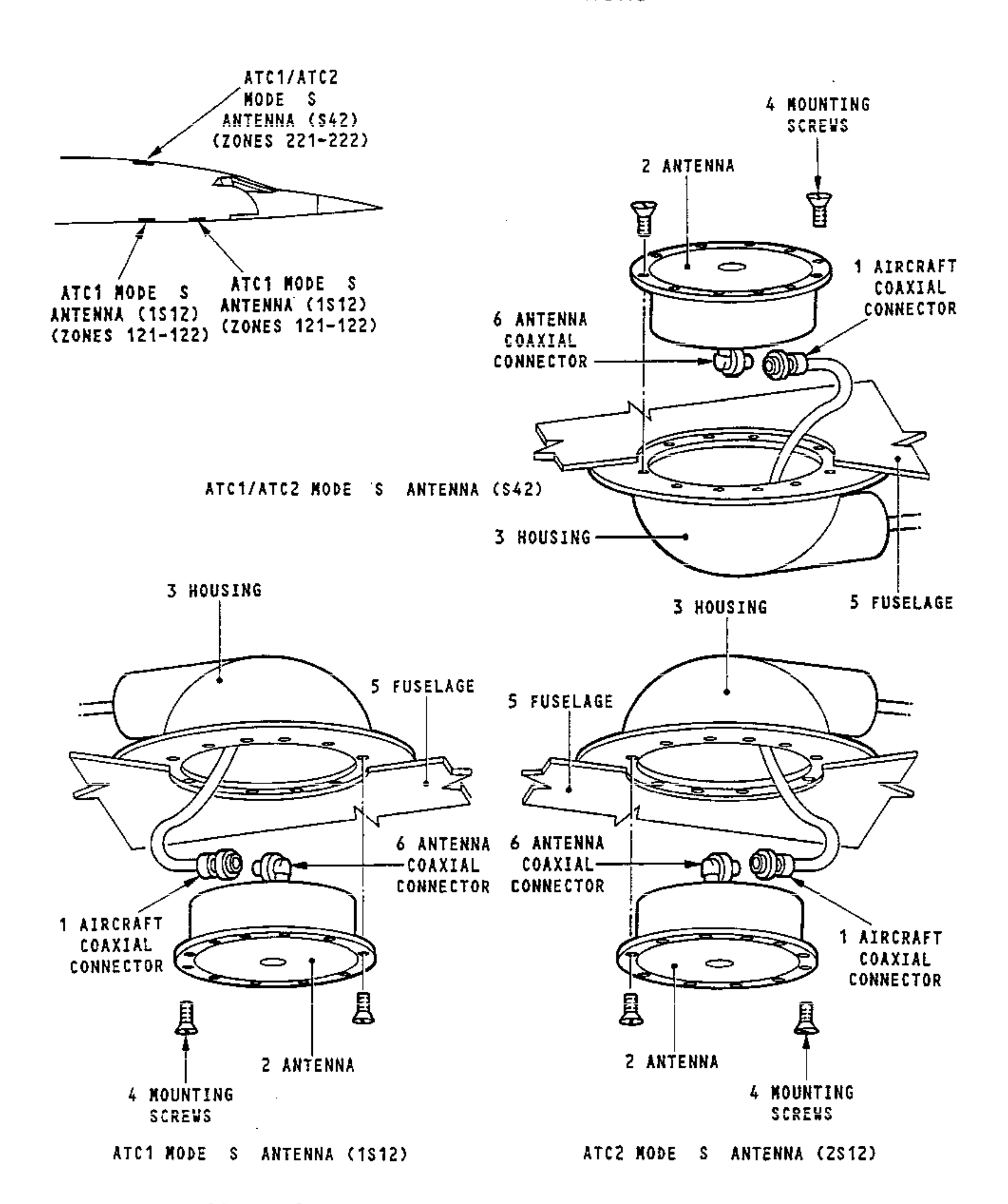
(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 Mode S	2-213	S 13	G20
ATC2 Mode S	13-216	S 14	F 7

(2) ATC1 Mode S

(a) Place access platform (*) under lower ATC1 Mode S antenna to be removed, in zone 121-122.

(b) Place access platform (**) level with upper ATC Mode S antenna to be removed, in zone 221-222.



ATC Mode S Antennae : Removal/Installation
Figure 401

(3) ATC2 Mode S

(a) Place access platform (*) under lower ATC2 Mode S antenna to be removed, in zone 123-124.

(b) Place access platform (**) level with upper ATC2 Mode S antenna to be removed, in zone 221-222.

C. Remove (Ref. Fig. 401)

(1) Progressively loosen, remove and retain the 12 mounting screws (4) while manually supporting antenna (2).

(2) Remove antenna (2) with its gasket from its housing (3) and disconnect aircraft coaxial connector (1) from antenna connector (6).

(3) Clean antenna mounting area on fuselage (5) and check the anti-fretting ring for damage. Clean all traces of sealant from antenna mounting flange.

(4) Check condition of aircraft coaxial connector.

D. Preparation of Replacement Component

(1) Make certain that antenna is in good external condition and particularly that connector has no trace of corrosion.

E. Install

(1) Clean the countersunk surface of the aerial attachment holes on the mounting flange and underside of the fixing bolt heads (Ref. 20-27-11).

(2) Position antenna (2) and gasket (supplied with the antenna), near to its housing (3) and connect aircraft coaxial connector (1) to antenna connector (6).

(3) Position antenna and gasket in its housing on fuselage (5) in the orientation shown in Fig. 401 and while manually supporting antenna, install the 12 mounting screws (4).

(4) Torque tighten the 12 mounting screws (4) (Ref. 20-21-11).

(5) Apply PR1436G sealant around the perimeter of the antenna mounting flange.

(6) Connect one terminal of a bonding tester to the structure of the aircraft in the area of the antenna.

(7) Using a suitable clamp device to provide the necessary cross sectional area of contact on the other terminal, pass a current of 5 amp. between each antenna mounting screw (4) and the aircraft structure. Check that voltage drop across any screw does not exceed 5 millivolts.

(8) If necessary, to obtain bonding, remove screws (4), clean countersunk surface of the antenna attachment holes, located on the mounting flange and on the underside of the mounting screw heads (Ref. MM 20-27-11). Refit the screws (4) and repeat the bonding test.

F. Tests

(1) Remove safety clips and tags and reset the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 SUP MODE S	2-213	S 13	G20
ATC2 SUP MODE S	13-216	S 14	F 7

(2) Remove panel 215DS to gain access to shelf 5-215 (LH electronics rack).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) Carry out Prepare procedure for operational test (Ref. 34-52-00, Adjustment/Test).

(5) On centre console 9-211, on ATC Mode S control panel place :

(a) XPDR1-2 selector switch in position 1 or 2.

(b) Switch STBY - XPDR - TA - RA/TA - selector switch to STBY position.

(6) On LH electronics rack, shelf 5-215, on front panel of ATC transponder in operation, press test push-button.

(7) Carry out operational test of ATC. (Ref. 34-52-00 Adjustment/Test).

(8) Install panel 215DS on LH electronics rack.

G. Close-up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00).

(3) Remove access platform(s) from working area.

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ATC Mode S CONTROL UNIT S11 - REMOVAL/INSTALLATION

1. **General**

The ATC Mode S control unit S11, common to both ATC transponders, is located at the LH side of the centre console.

2. **Removal/Installation**

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	-
Blanking Caps	-

B. Prepare

(1) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC 1 Mode S	2-213	S 13	G20
ATC 2 Mode S	13-216	S 14	F 7
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8

(2) On panel 4-211, place CENTRE CONSOLE PANEL rotary switch in OFF position.

(3) On centre console panel 9-211, on ADC control panel, make certain that ADC1 and ADC2 ON-OFF switches are in OFF position.

R (4) On centre console panel 9-211, on ATC Mode S control
R unit make certain that :

R Selector STBY - XPDR - TA - RA/TA - selector switch in
R STBY position.

C. Remove ATC Mode S Control Unit

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.F.

F. Close-up

(1) Refer to 34-52-00, Adjustment/Test, Operational Test.

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ATC MODE S TRANSPONDERS 1S10 & 2S10 - REMOVAL/INSTALLATION

1. General

ATC Mode S transponders 1S10 and 2S10 are installed on shelf
R 5-215, RH side.

2. Removal/Installation

As the ATC Mode S transponders are identical, removal/installation of ATC1 Mode S transponder 1S10 only will be described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Ventilation Outlet Blanking Plate	

B. Prepare

(1) Remove panel DS from shelf 5-215.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ATC1 Mode S	2-213	S 13	G20
ATC2 Mode S	13-216	S 14	F 7

(3) On centre console panel 9-211, on ADC control panel, make ensure that ADC1 and ADC2 ON-OFF switches are in OFF position.

R (4) On centre console panel 9-211, on ATC Mode S control
R panel, ensure that :

R Selector STBY - XPDR - TA - RA/TA selector switch in
R STBY position.

R C. Remove ATC1 Mode S Transponder

R (1) Gain access to shelf 5-215.

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.D.(1).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.F.(1).

F. Test

R (1) Carry out on ATC1 Mode S (ATC2 Mode S) test in self-test mode (Ref. 34-52-00, Adjustment/Test, Operational Test).

G. Close-up

(1) Install panel DS on shelf 5-215.

R (2) Reset circuit breakers tripped in Para. B.(2).

1. General
(Ref. Fig. 001)

The aircraft is equipped with two independent and identical ADF systems.
The ADF (automatic direction finding) is a radio navigational aid system. The system provides for the locating and the aural monitoring, and for the bearing to be taken of a radio navigation beacon identified by its aural identification signal and whose geographical location is known to the pilot. In ADF mode, the system continuously indicates the magnetic bearing of the beacon on an RMI indicator. The indicator needle provides indication of the direction of the beacon.

2. System Components
(Ref. Fig. 002)

A. Components of One System

A system comprises a receiver ADF, a controller common to the two systems, a sense antenna, a loop antenna, a sense cable equalizer and a quadrantal error corrector. Also common to the two systems, two RMI (Radio Magnetic Indicators) enable continuous reading of the bearing. These indicators are for the use of the captain and co-pilot.
The assembly comprises two identical systems.

B. Power Supply

The 28VDC and 26VAC supplies required for system operation are distributed through circuit breakers via the dual controller.

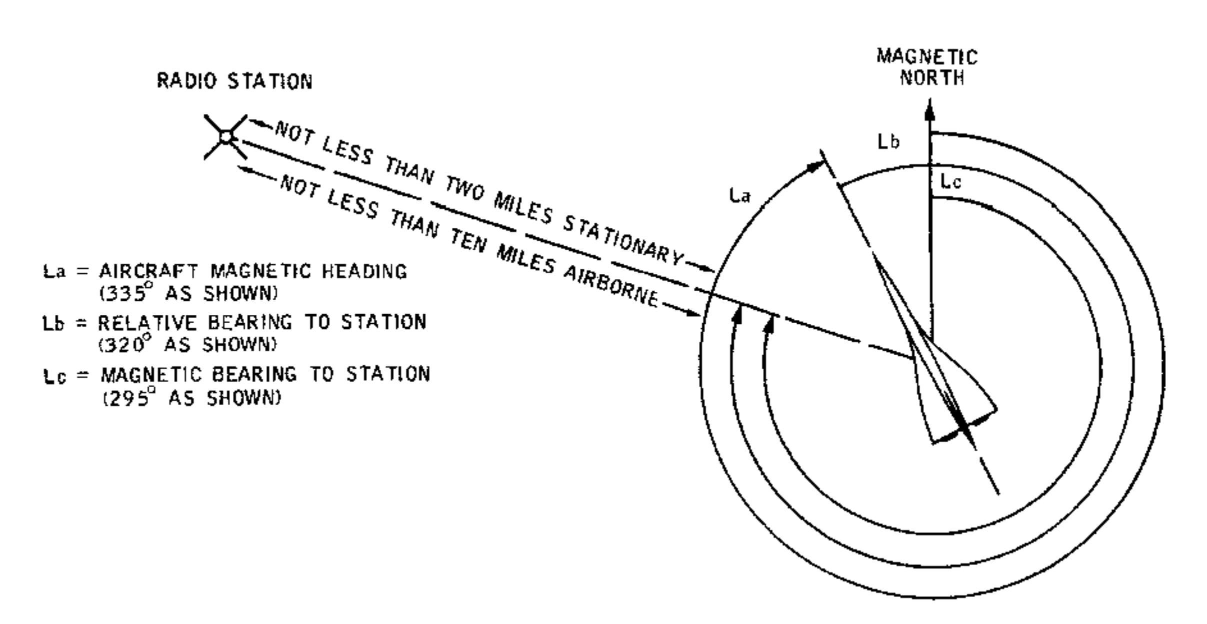
3. Receiver ADF Marconi-Elliot AD380
(Ref. Fig. 003)

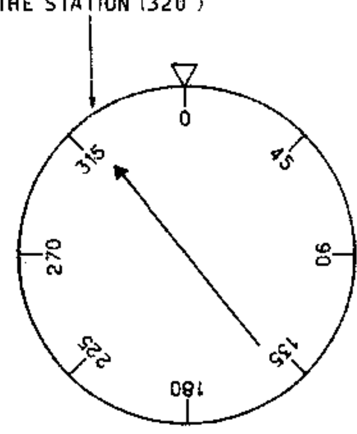
A. Description

The receiver, contained in an ATR short case, is entirely transistorised.
All connections with the aircraft are made by means of a rear connector.
The front panel contains :

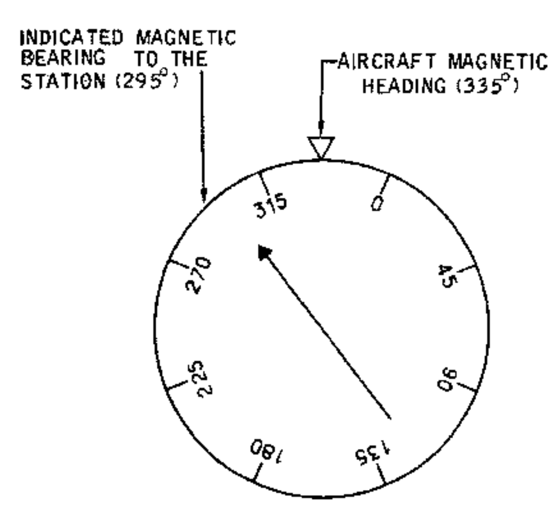
(1) A self-test button accessible through a hole in the cover.

(2) A bearing indicator visible through a hole in the co-





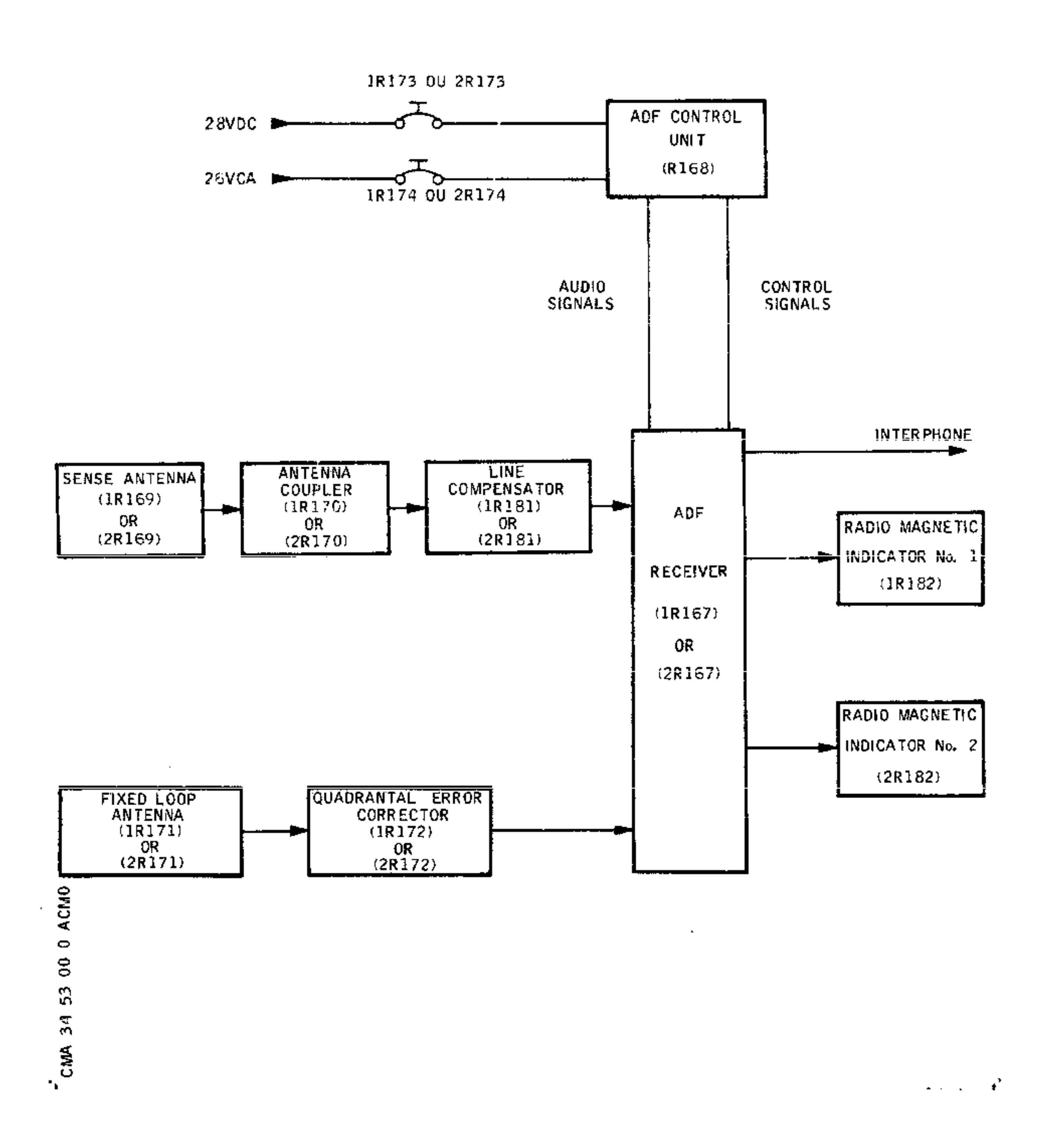
FIXED CARD INDICATOR



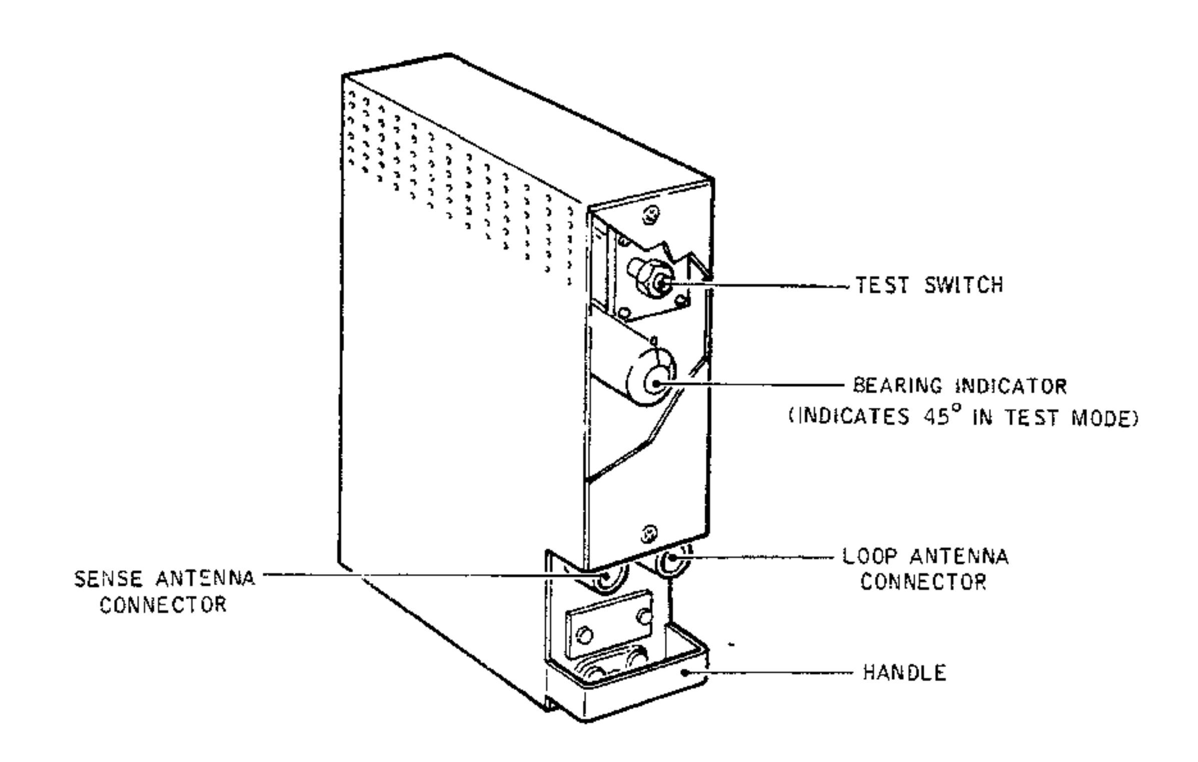
RADIO MAGNETIC INDICATOR (RMI)

CMA 34 53 00 0 AAM0

ADF Bearings : Terminology
Figure 001



ADF System Block Diagram
Figure 002



ADF Receiver - Front View
Figure 003

ver.

(3) A loop antenna connector on the RH side under the 'doghouse'.

(4) A sense antenna connector on the LH side under the 'doghouse'.

(5) A carrying handle.

B. Operation

The receiver is a triple-conversion superheterodyne. It covers the band 190 to 1799.5 kHz in nine sub-bands by logic system. Tuning is made in 0.5 kHz steps. It operates in ADF or ANTENNA mode according to selection, and comprises six major parts :

HF stages
Mixer and IF stages
Audio-frequency stages
Servo loop

Control circuit
Test circuit

(1) HF Stages (Ref. Fig. 004)

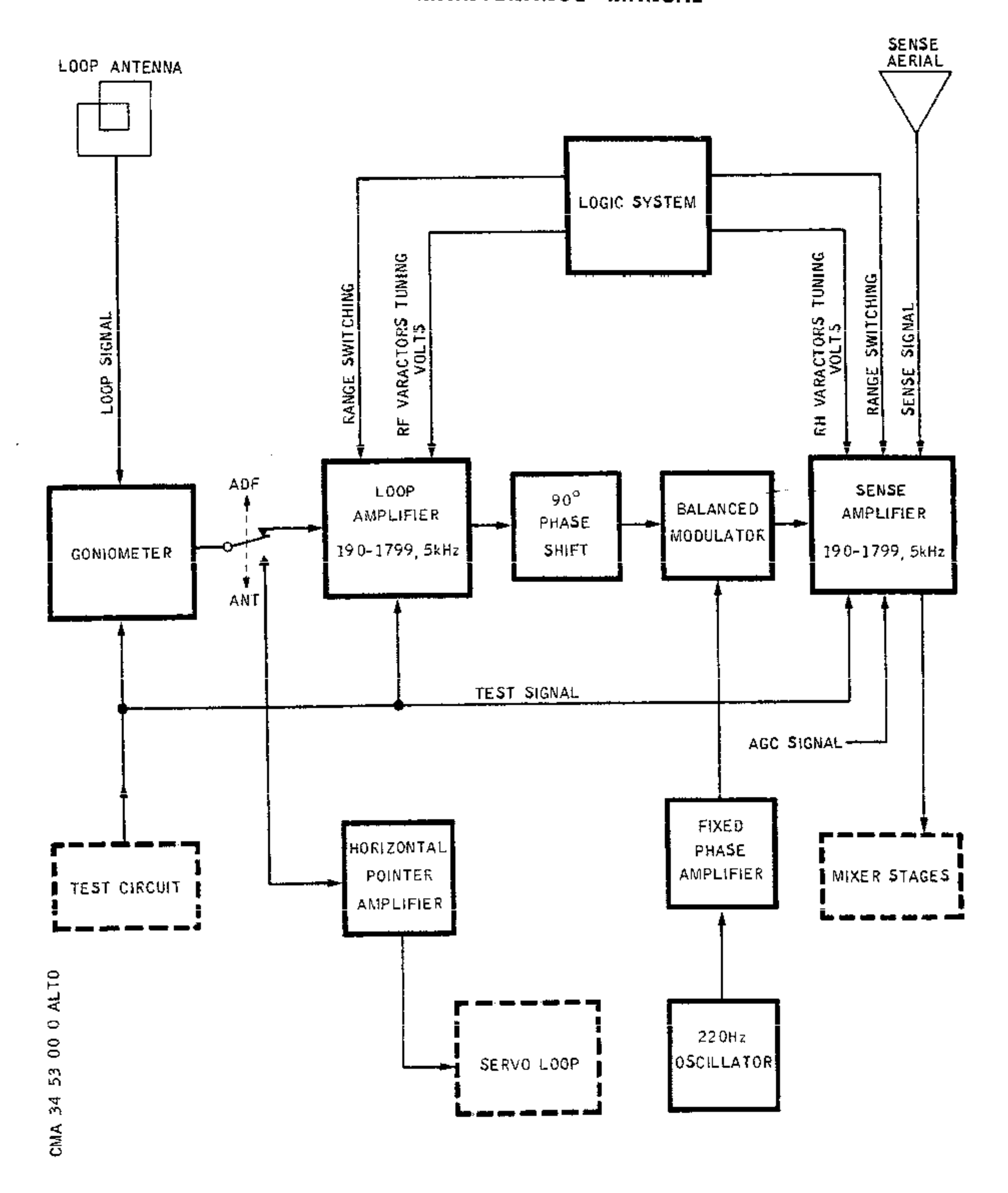
(a) Coupler amplifier

In ADF mode the coupler signal from the two stator windings is induced into the search coil, which directs the resultant signal to the coupler amplifier. Three basic tuner bands are required to tune the input circuit and they are tuned by transformers linked to their respective varactor variable capacity diodes. Operation of one of the three circuits is monitored by the logic system, itself controlled according to the frequency selected on the controller. The tuned HF signal is amplified and then applied to a loop circuit which enables a 90° phase shift before combining with the sense signal.
The phase shift output signal is sent to a phase separator the two outputs of which are applied via condensors to the balanced modulator diodes which are controlled by a 220 Hz signal from the fixed phase amplifier. The diodes are alternately turned off by the 220 Hz signal and turned on by phase opposition of the coupler signal. The balanced modulator output is fed to the sense amplifier.

- In ANT mode the ADF circuit is isolated. A relay contact in the goniometer circuit connects the search coil to the horizontal sense amplifier. The 220 Hz output from the oscillator is sent to a stator winding of the goniometer and to the reference winding of the bi-phase motor. In this mode the goniometer functions as a synchro-transmitter and the bearing reading on the indicators is 90°.

(b) Sense amplifier

The signal captured by the sense antenna is sent to a 3-band basic tuner input circuit, which itself receives the HF signal from the balanced modulator.
The three bands are tuned by transformers associated with a single Varactor diode. One of the three circuits is energized by logic system control, depending on the frequency selected on the controller.



ADF Receiver - HF Stages Block Diagram
Figure 004

The tuned HF loop and sense signals are sent to the sense amplifier, which also receives the AGC voltage. The resultant amplified HF signal, modulated to 220Hz, is then delivered to the mixer stages.

(2) Mixer and IF stages (Ref. Fig. 005)

(a) Mixer circuit

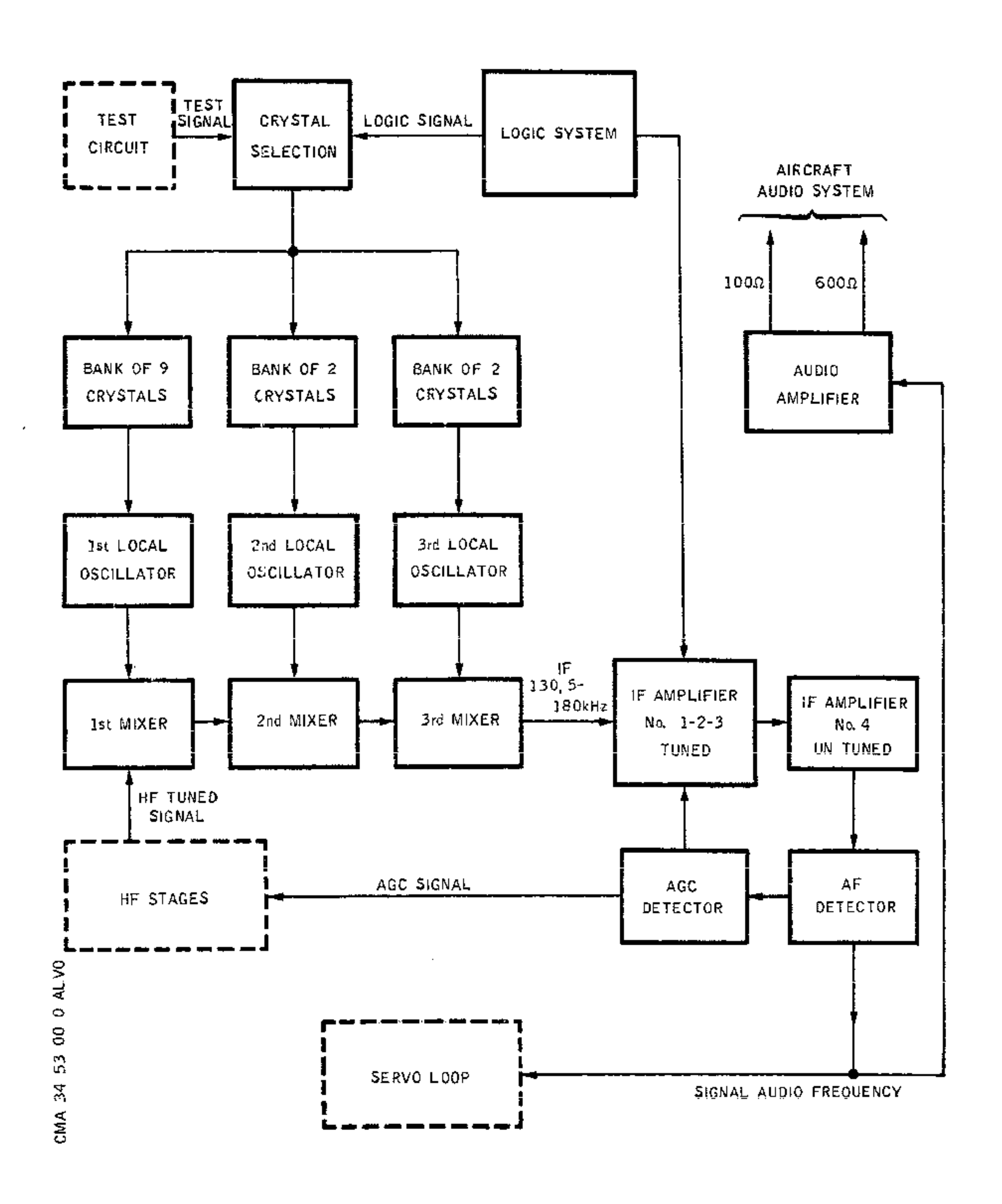
The tuned HF signal from the sense amplifier supplies the three-stage mixer circuit via an inductance.
The mixer circuit consists of three crystal controlled oscillators and three mixers with their associated components. The crystals are connected to the oscillators tuned to the selected frequency. The crystal chosen for the :
1st local oscillator is selected from a 9-crystal bank
2nd local oscillator is selected from a 2-crystal bank
3rd local oscillator is selected from another 2-crystal bank.

The selection is made via transistors switched by the logic system according to the frequency selected on the controller.
The mixer circuit output provides an intermediate frequency in the 130.5 kHz to 180 kHz band.

(b) If amplifiers

The IF signal from the final mixer is applied to the intermediate frequency amplifier circuit.
The system comprises three tuned and one untuned amplifier.
The first three amplifiers are tuned by Varactor diodes via IF transformers mounted in bandpass configuration, and are supplied from the DC amplifier monitored by the logic system according to the frequency selected on the controller. The AGC voltage is applied to the tuned IF amplifiers.
The third IF tuned amplifier additionally receives a signal of 1 kHz triggered by test operation or BFO (beat frequency oscillator) action.
The fourth, untuned, oscillator directs the intermediate frequency signal to the audio frequency circuits.

(3) Audio frequency stages (Ref. Fig. 005)



ADF Receiver - IF and Audio Mixer Stages -
Block Diagram
Figure 005

(a) BF detector

The fourth IF amplifier output is applied to the BF detector input, which transmits the audio signal, after detection, to :
- the audio amplifiers circuit
- the AGC detector
- the servo loop circuit.

(b) AGC detector

The detected BF signal is delievered to the AGC detector circuit, which supplies the three tuned amplifiers and the IF sense amplifier via an impedance inverter.

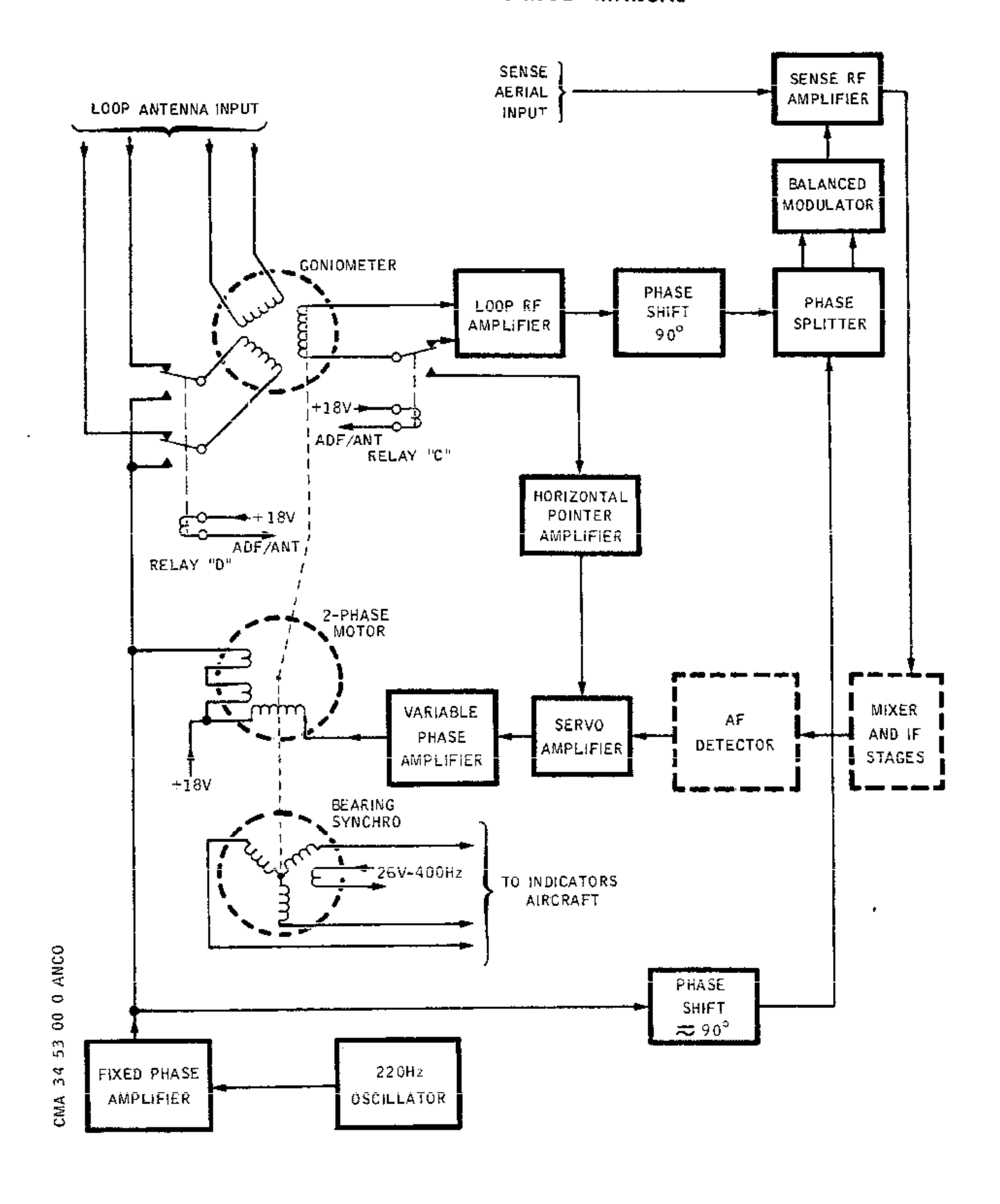
(c) Audio amplifiers

The detected BF signal is applied to the audio amplifiers which distribute it after amplification to the aircraft audio system via an output transformer with an impedance load of 600 or 100 ohms.

(4) Servo loop (Ref. Fig. 006)

(a) In ADF mode

The signal from the 220Hz oscillator is applied to the fixed phase amplifier which supplies the reference phase windings of the goniometer bi-phase motor. The 220 Hz amplified signal is also used for switching the balanced modulator in the HF coupler circuit after a phase shift of 90°.
The signal from the BF detector is applied to the servo amplifier which then sends the information to the variable phase amplifier, providing a variable phase supply to the goniometer bi-phase motor control phase winding.
The loop antenna signal at the receiver input is 90° retarded with respect to the sense antenna and is consequently phase shifted 90° after amplification in the HF loop in order to be added to the sense signal.
The phase separation supplied by the loop signal, phase shifted but in phase opposition, applies the resultant signal to the balanced modulator, which releases the loop signal at each switching signal half cycle. Alternately in phase, or phase shifted 180° with respect to the sense signal, each line consequently increases or decreases its amplitude



ADF Receiver - Servo Loop Block Diagram
Figure 006

in order to sum the two signals in the HF sense amplifier stage. The output of this stage is a tuned HF signal with a 220Hz modulation envelope. The modulation level depends on the loop signal amplitude, and falls to zero when the goniometer search coil is directed to a zero coupling of the HF magnetic signal selected. The modulation phase is inverted when the goniometer search coil output phase is inverted, as it passes across the two zero coupling positions. Thus when the modulation frequency is covered by the detected BF signal and supplies the winding of the goniometer 2-phase motor, via the variable phase amplifier, its phase is advanced or retarded 90° with respect to the fixed phase supply to the reference phase windings, depending on the position of the goniometer search coil. Consequently when the control phase is advanced 90° with respect to the fixed phase, the motor shaft turns in one direction, and turns in the opposite direction when retarded 90°. The motor stops when there is no controls phase voltage.
The bearing synchro is coupled mechanically to the goniometer search coil and 2-phase motor, to provide an output indication corresponding to the position of the search coil.

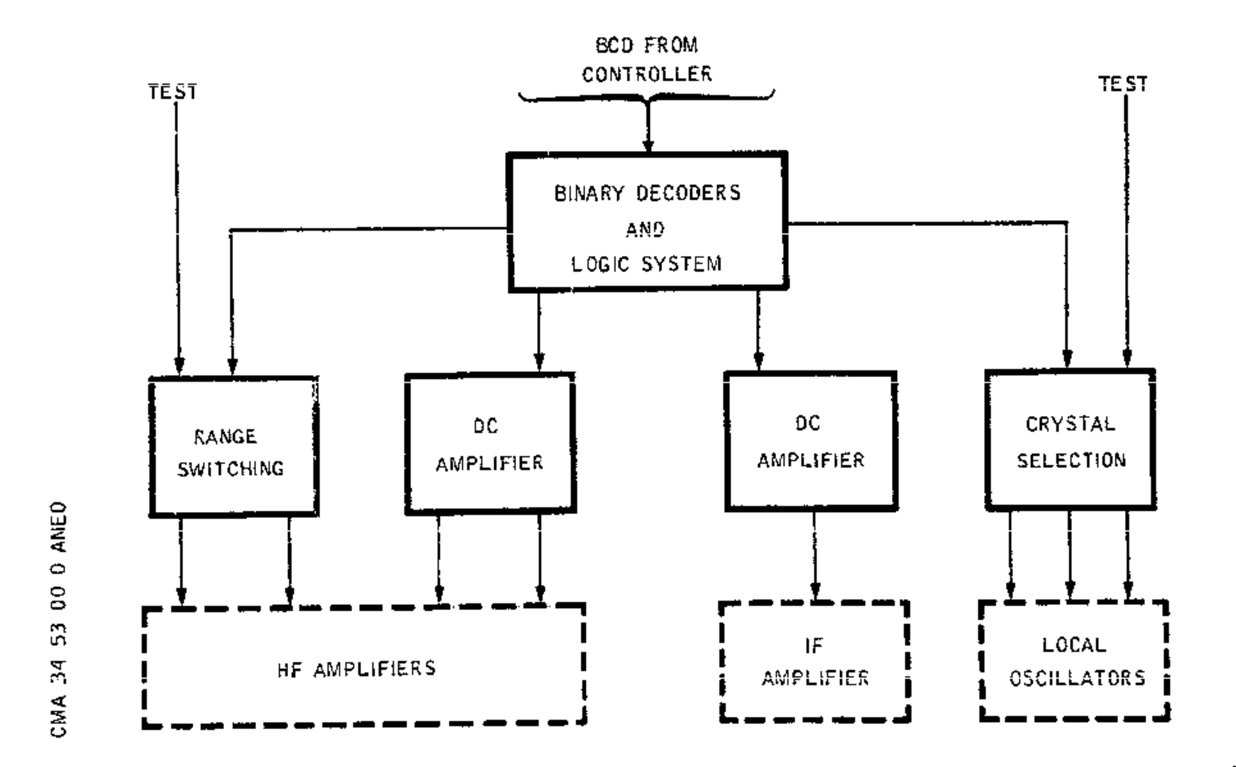
(b) In ANT mode, energization of relay C cuts off the supply to the loop amplifiers and connects the search coil to the horizontal bearing amplifier which applies the signal to the servo amplifier. Relay D energizes, which applies the 220 Hz signal from the fixed phase amplifier to a stator winding of the goniometer. The goniometer functions as a resolver, and the bearing reading on the indicators is 90°.

(5) Control circuits (Ref. Fig. 007)

The "binary decoders and logic system" module receives the fourteen frequency control lines from the controller and converts the binary data to logic levels. The logic signals from this module are applied to :

(a) The "range switching", which selects the appropriate range for the HF loop and sense amplifiers.

(b) The DC amplifiers, which set the polarization potential of the various HF loop and sense amplifier varactor diodes, as well as the first three tuned IF amplifiers.



ADF Receiver - Control Circuits
Figure 007

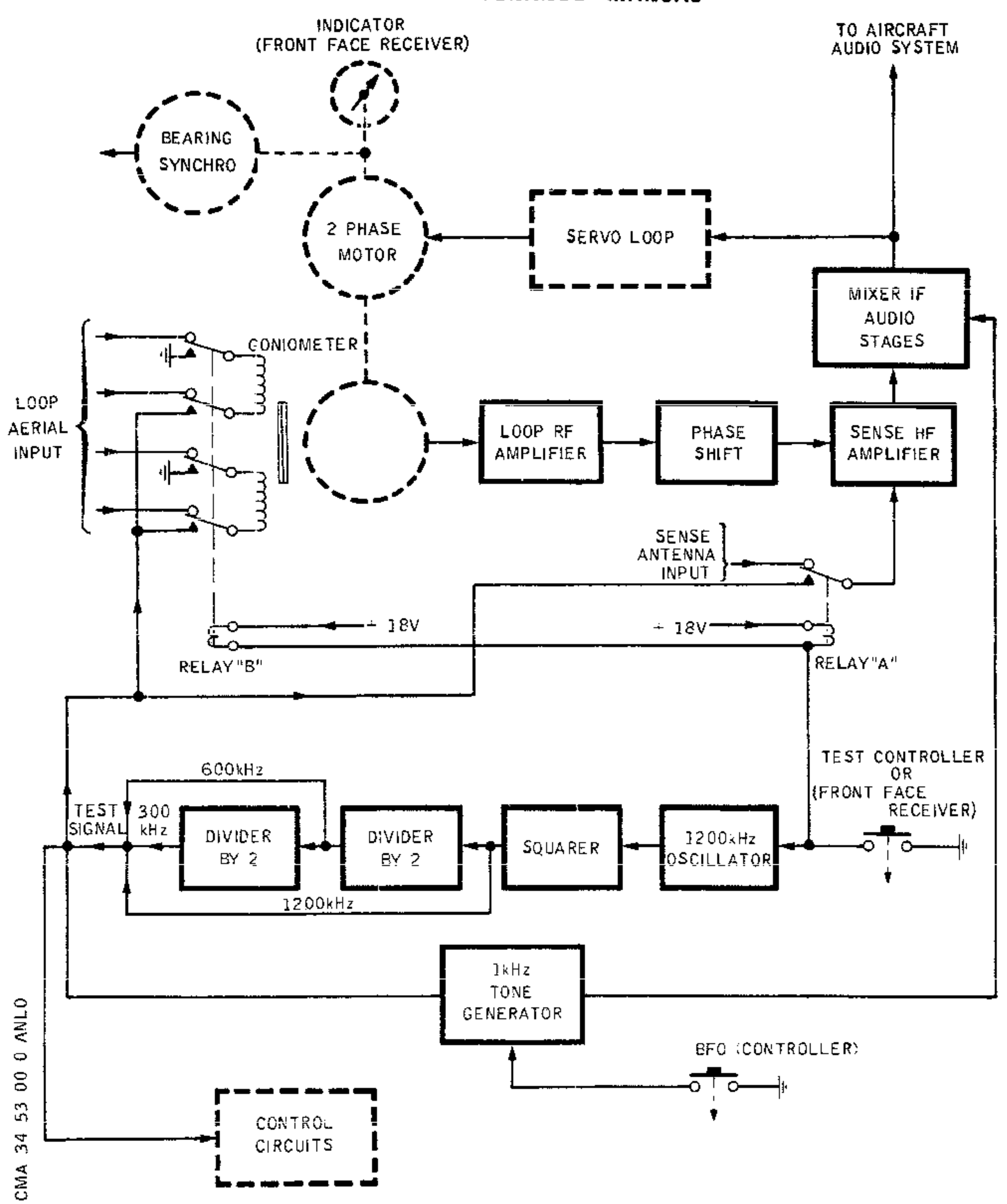
(c) The "crystal selection", which selects the appropriate crystal for the local oscillators.

NOTE : In TEST function the "range switching" and "crystal selection" are tuned to the test signal.

(6) TEST Circuit (Ref. Fig. 008)

The test circuit is activated when the TEST push=button on the controller or on the front of the receiver is pressed. The "test" stage consists of a 1200 kHz crystal type oscillator. Output from the oscillator is applied via a square wave circuit to a first divider-by-two which supplies range 2, or a 600 kHz signal. A second divider-by-two at the divider output supplies the range 1, or 300 kHz signal. Range 3, a 1200 kHz signal, is directly applied by the square wave circuit.

When the push-button is pressed :



CMA 34 53 00 0 ANLO

ADF Receiver - Test Circuit
Figure 008

(a) Relay A is energized, the sense antenna input is disconnected and the test signal is applied to the HF sense amplifier input circuit.

(b) Relay B is energized, the goniometer antenna input is replaced by the test signal which is applied to the two bearing windings. Equal in amplitude and phase, the signals produce a 45° bearing indication on the goniometer indicator located on the front panel of the receiver and on the aircraft bearing indicators.

(c) The test signal is applied to the "range switching" and to the "crystal selection", which tune the HF amplifier and local oscillator circuits.

(d) The 1 kHz tone generator is triggered and a signal is applied to the 3rd IF amplifier which after passing the audio circuits produces an audio signal of 1000 Hz which is sent to the aircraft audio system.

NOTE : This audio signal can also be triggered by pressing the BFO push-button on the controller.

4. Controller ADF GABLES G3749
(Ref. Fig. 009)

A. Description

The ADF controller is common to the two ADF systems.
It consists of a rectangular case containing all controls required for remote operation of the two ADF systems.

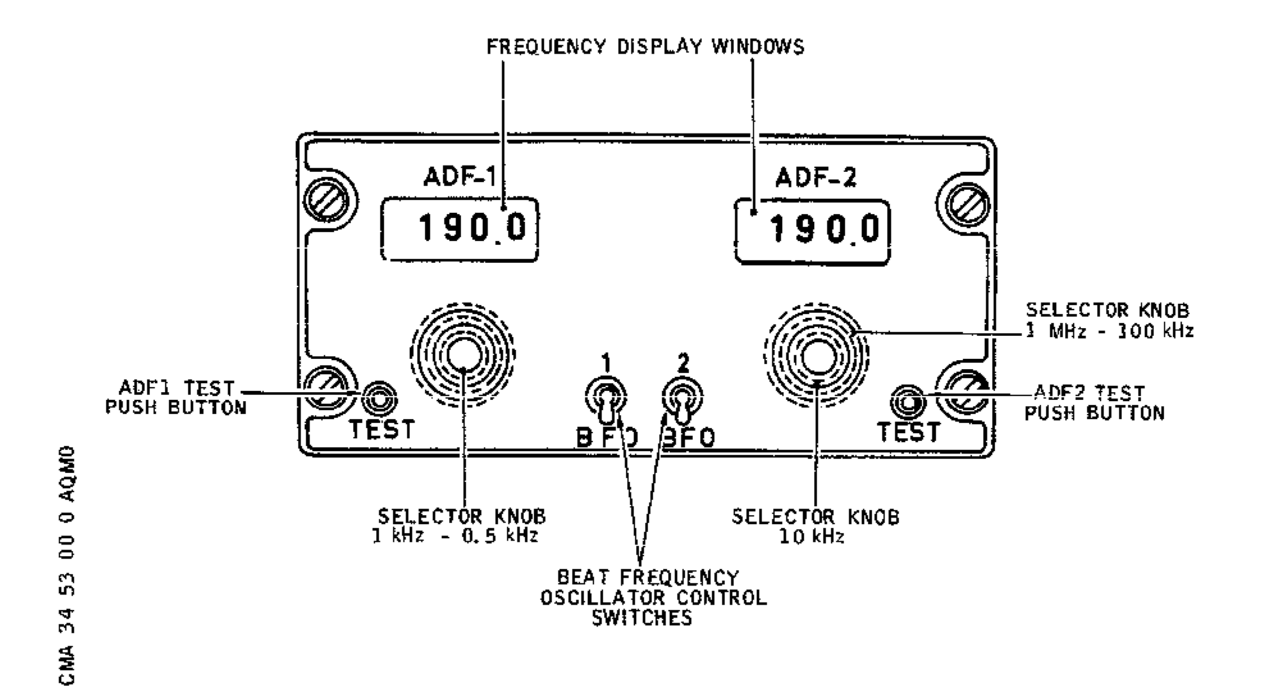
B. Operation

(1) On the front panel are :

(a) Two frequency display windows, one for system 1 the other for system 2. They display the selections made on their associated knobs.

(b) Below the two display windows is a three-concentric-knob assembly for frequency selection enabling :

- By the central knob, frequency selection of 1 KHz and 0.5 KHz
- By the intermediate knob frequency selection of 10 KHz



ADF Controller : Front View
Figure 009

- By the outside knob frequency selection of 1000 Hz and 1 KHz.

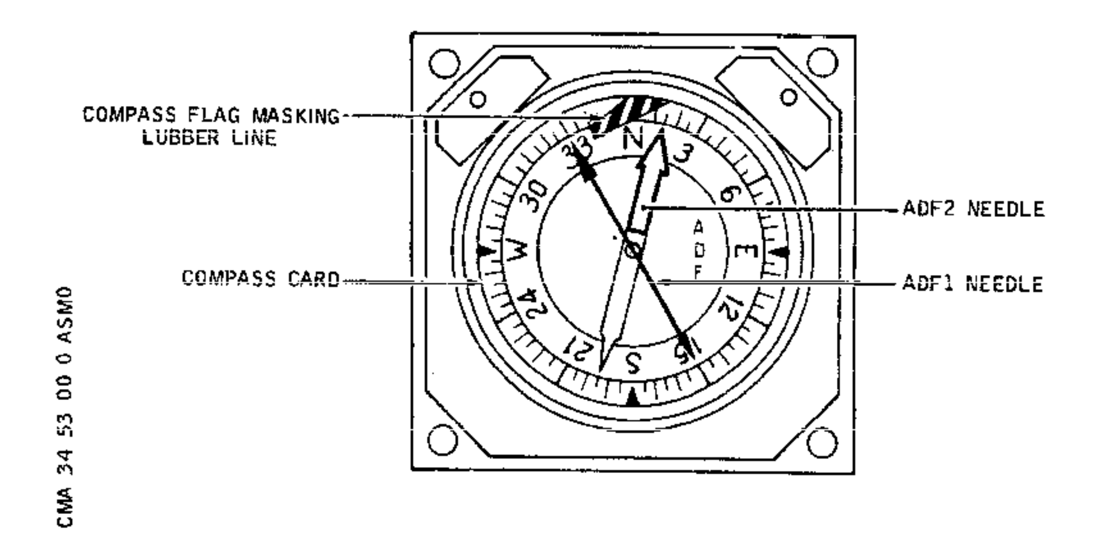
(c) In the lower right and left corners, a TEST push-button for each ADF system.

(d) At lower centre, two BFO switches, one for each ADF system. When the switch is placed in the BFO position, a beat frequency oscillator is switched on. This oscillator is used for reception of unmodulated beacon signals (A1 CW) : a 1000 Hz signal is audible in the headset for reading of the beacon identification code.

(2) On rear panel, a receptacle for connection to the two ADF systems.

5. <u>Bearing Indicator RMI/ADF - E.A.S. 1VA 551D (Ref. Fig. 010)</u>

A. Description



ADF Indicator : Front View
Figure 010

The indicator displays the following information :

- Aircraft magnetic heading
- Two ADF bearings
- A compass warning flag.

It is contained in a sealed instrument case, in an inert medium of nitrogen and helium. The case and the front panel are coloured Grey. The indicator has white internal illumination. The bulbs are accessible from the front. In case of malfunction, a compass warning flag appears in the upper part of the indicator, in front of the lubber line of the compass card. The aircraft magnetic heading is read on a matt black printed compass card graduated in five degree increments. The card is also marked with numerical indications at thirty degree intervals, as well as white N, E, S and W indicators. Reading is made with respect to the lubber line. The bearings are indicated by two needles (red & green), moving in front of the compass card. The single needle corresponds to ADF1 bearings, the double needle corresponds to ADF2 bearings. Connection to the aircraft

circuits is made by a connector at the rear of the case.

B. Technical Characteristics

Compass card precision	± 0.5°
Servo control threshold	0.2°
Servo control rate	Greater than 30° per second
Bearing	Better than one degree precision with respect to the ADF information.

C. Operation (Ref. Fig. 011)

The indicator fulfils two functions. It indicates :

(1) The magnetic heading, from information originating in the compass coupler.

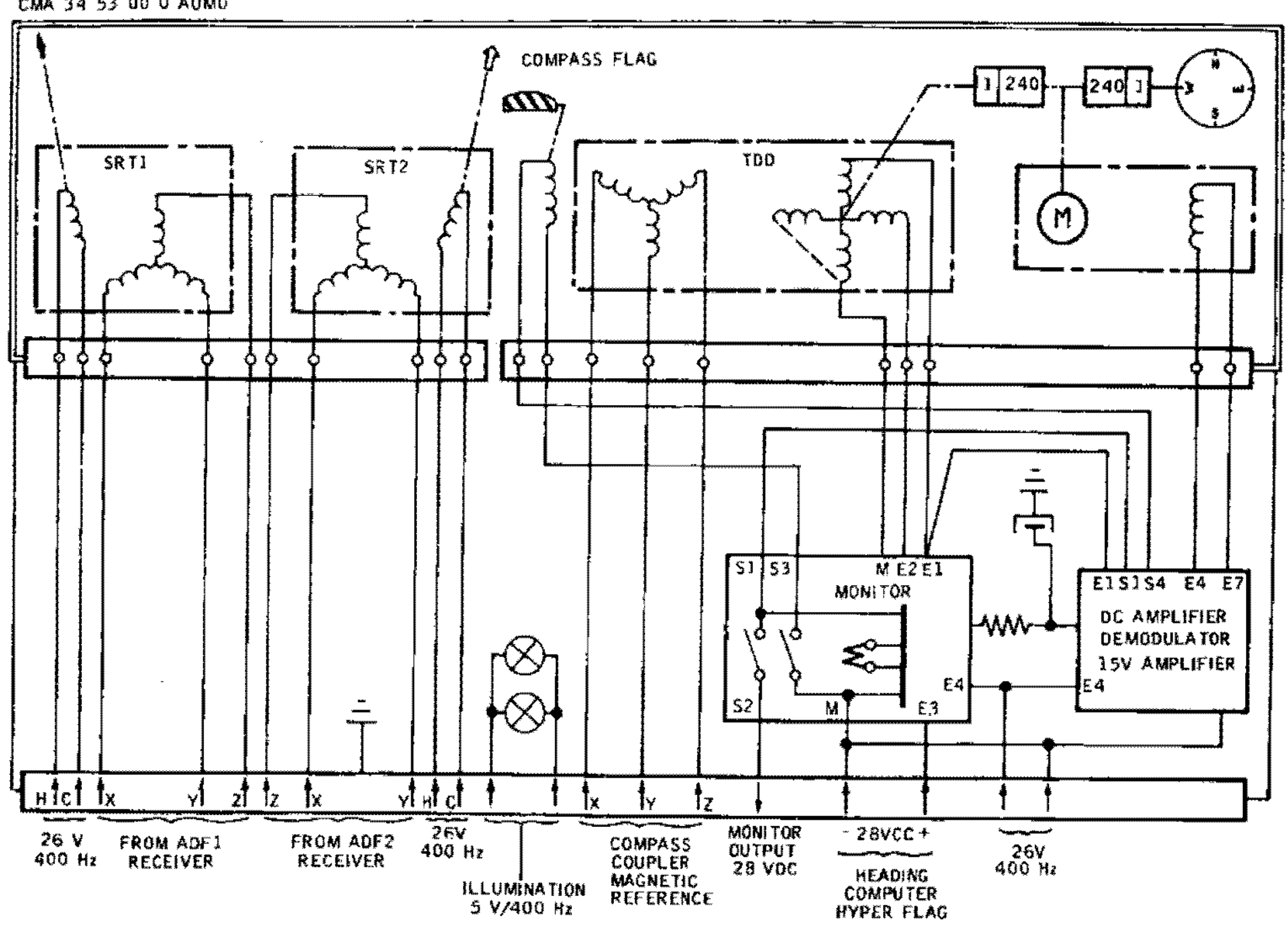
(2) Bearings 1 and 2, from information originating in the ADF1 and ADF2 systems.
The servo-mechanisms installed in the case present indications on the front face from information originating in the systems in the form of electrical control signals. The indicator comprises in addition : power supply, demodulator stage, amplifier stage and monitor circuit.

(3) The compass coupler information, magnetic reference control, is applied to the transolver differential detector. The error voltage thus introduced is fed to the demodulator which is also fed with 26 Volts, 400 Hz from the power supply. This error voltage, after demodulation, applies a direct voltage - proportional to the alternating voltage from the transolver - to the direct current amplifier, the amplifier supplies the motor which positions the compass card, to which it is coupled through a gear train, thus repeating the aircraft magnetic heading. The motor is powered by a regulated 15 Volts supply.

(4) ADF1 and ADF2 control information is applied to the SRT1 and SRT2 remote indication synchro-receivers. The rotor, supplied by 26 Volts, 400 Hz, repeats the angular position.
The needle, linked to the rotor, enables the reading of the ADF bearing.

(5) Monitoring Circuit

The monitoring circuit is applied by regulated 15 Volts power and indicates a fault when any of the



Radio Magnetic Indicator - Schematic
Figure 011

following four conditions arise :

(a) An error greater than two degrees.

(b) An error originating in the transolver differential detector.

(c) An error caused by a voltage reduction. (The indicator operates normally between 26 Volts and 20 Volts, 400 Hz).

(d) An error due to a voltage reduction in the 28 Vdc network.
A malfunction detected in one of the monitoring circuits causes the appearance of the compass warning flag.

6. System Operation

Depending on the selection made on the controller, two modes of operation are possible :
ANTenna mode - ADF mode.

A. Start Up

The system is energized as soon as the circuit breakers are reset, and the aircraft electrical network energized. The selected system is immediately operational.

B. Mode Selection

(1) In Antenna mode, as the controller unit is not equipped for the function, the mode is not operative.

(2) In ADF mode, radio compass operation is entirely automatic. The signals received at the loop and sense antennas are combined and processed in the receiver to produce bearing and identification information.

C. Bearings

The bearings are supplied to the Captain and First Officer on two RMI indicators. They enable the reading of :

- Aircraft magnetic heading read on a compass card
- The two ADF1-ADF2 bearings.

D. Loop Antennas

The loop antenna comprises two pairs of perpendicular coils, wound on ferrite cores. The assembly is housed in an alumi-

nium casing, covered by a glass-fibre fairing. It is mounted on the top of the aircraft, in the longitudinal axis. Two of these coils are parallel to this axis ; the received signals are applied to the ADF receiver via the quadrantal error connector.

E. Quadrantal Eror Corrector

A component comprising inductors and capacitors, the quadrantal error corrector is connected between the loop antenna and the line to the receiver, it compensates for loop antenna-receiver line length, attenuates errors due to HF magnetic field effects caused by the aircraft structure.

F. Line Equalizer

The line equalizer matches and simulates the required line length for the installation.

G. Antenna Coupler

The sense antenna coupler housed in a casing matches the antenna impedance to the input capacitance of the receiver.

AUTOMATIC DIRECTION FINDING (ADF) - TROUBLE SHOOTING

WARNING : OBSERVE THE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00 SERVICING

1. General

The most probable basic faults are treated in their order of importance and are identified by test results. They can occur in flight or on the ground.
The defects can be isolated with the aid of the trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information including component location required for rectification.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101). The two systems are identical, trouble shooting procedure is described for system 1. For system 2 procedure is identical, replacing system number by number in parentheses.

2. Prepare

A. Configuration Ref. 34-53-00, Adjustment/Test

3. Trouble Shooting

```
***************************************************************
* SELF-TEST system 1 (2). On dual ADF control unit           *
* place BFO1 (2) switch in BFO position. Press and           *
* hold TEST1 (2) push-button. RMI/ADF single pointers*
* go to 45° position, 1000 Hz signal is audible in           *
* headset. IF                                                 *
***************************************************************
    |         |
    |         |     ----------------------------------------------------
    |  NOT OK-| Audio signal correct. RMI/ADF single pointers do |
    |         | not move                                         |
    |         |     ----------------------------------------------------
    |         |               |
    |         |     ----------------------------------------------------
    |         |     | Check presence of COMPASS flag on RMI/ADF [1] [2]|
    |         |     ----------------------------------------------------
    |         |               |                                |
    |         |               OK                          NOT OK
    |         |               |                                |
    |         |     ------------------------------  --------------------
    |         |     | Check continuity between   |  | Replace ADF recei- |
    |         |     | terminals J and H on ADF   |  | ver [3] (No.2 [4]) |
    |         |     | 1 (ADF2) control unit      |  --------------------
    |         |     ------------------------------
    |         |               |                  |
    |         |               OK             NOT OK
    |         |               |                  |
    |         |     -------------------------  ---------------------------
    |         |     | Check circuit breaker|  | Replace ADF 1 and 2      |
    |         |     | [5] [6] 26VAC output |  | control unit [7]         |
    |         |     -------------------------  ---------------------------
    |         |
    |         |     ----------------------------------------------------
    |  NOT OK-| On one of the RMI/ADF, pointer ADF1 does not        |
    |         | indicate 45°. Replace faulty RMI/ADF                |
    |         |     ----------------------------------------------------
    |         |
    |         |     ----------------------------------------------------
    |  NOT OK-| No AUDIO signal. RMI/ADF operate correctly. Check|
    |         | reception at another interphone station.           |
    |         |     ----------------------------------------------------
    |         |               |                  |
    |         |               OK             NOT OK
    |         |               |                  |
    |         |     ----------------------  ------------------------------
    |         |     | Replace faulty     |  | Replace ADF receiver [3]   |
    |         |     | jack panel         |  | (No.2 [4])                 |
    |         |     ----------------------  ------------------------------
    |         |                                  |
```

OK

NOT OK

Printed in England

```
   |         |                                           |
   |         |                            -------------------------------
   |         |                            | Replace ADF 1 and 2 Control |
   |         |                            | Unit [7].                   |
   |         |                            -------------------------------
   |         |
   |         |        -------------------------------------------------
   |     NOT OK |     | TEST does not operate. Ref. Chart 101.         |
   |                  -------------------------------------------------
   |
*****************************************************
* Check ADF1 (2) operation with known ground station *
* IF                                                 *
*****************************************************
             |
             |        -------------------------------------------------
             |        | Correct reception. RMI/ADF 1 (2) pointers turn |
         NOT OK       | continuously. Replace ADF [3] ([4]) receiver   |
             |        -------------------------------------------------
             |                    |
             |                  NOT OK
             |        -------------------------------------------------
             |        | Check antenna circuit. Replace faulty component. |
         NOT OK       | Sense antenna [8] [9], Antenna coupler [10] [11],|
             |        | Sense cable equalizer [12] [13].                 |
             |        -------------------------------------------------
             |
             |        -------------------------------------------------
         NOT OK       | Correct reception. Bearings incorrect, replace |
             |        | ADF receiver [3] [4].                          |
             |        -------------------------------------------------
             |                  |
             |                NOT OK
```

Check loop antenna circuit: Replace faulty component: Loop antenna [14] ([15]), Quadrantal Error Corrector [16] ([17]), Cable Assy [18] ([19])

NOT OK – Incorrect ADF operation on certain sub-bands

NOT OK

Replace ADF receiver [3] ([4]).

NOT OK

Replace ADF 1&2 Control Unit [7]

NOT OK – Readings on the two RMI/ADF do not match. Replace faulty RMI

NOT OK – BFO does not function. With BFO switch in position 1 (2), check continuity between ground terminal on Control Unit and pin F

- OK → Replace ADF [1] ([2]) receiver
- NOT OK → Replace ADF 1&2 Control Unit [7]

NOT OK – Reception muting inoperative during frequency changes : Replace ADF receiver [3] ([4)].

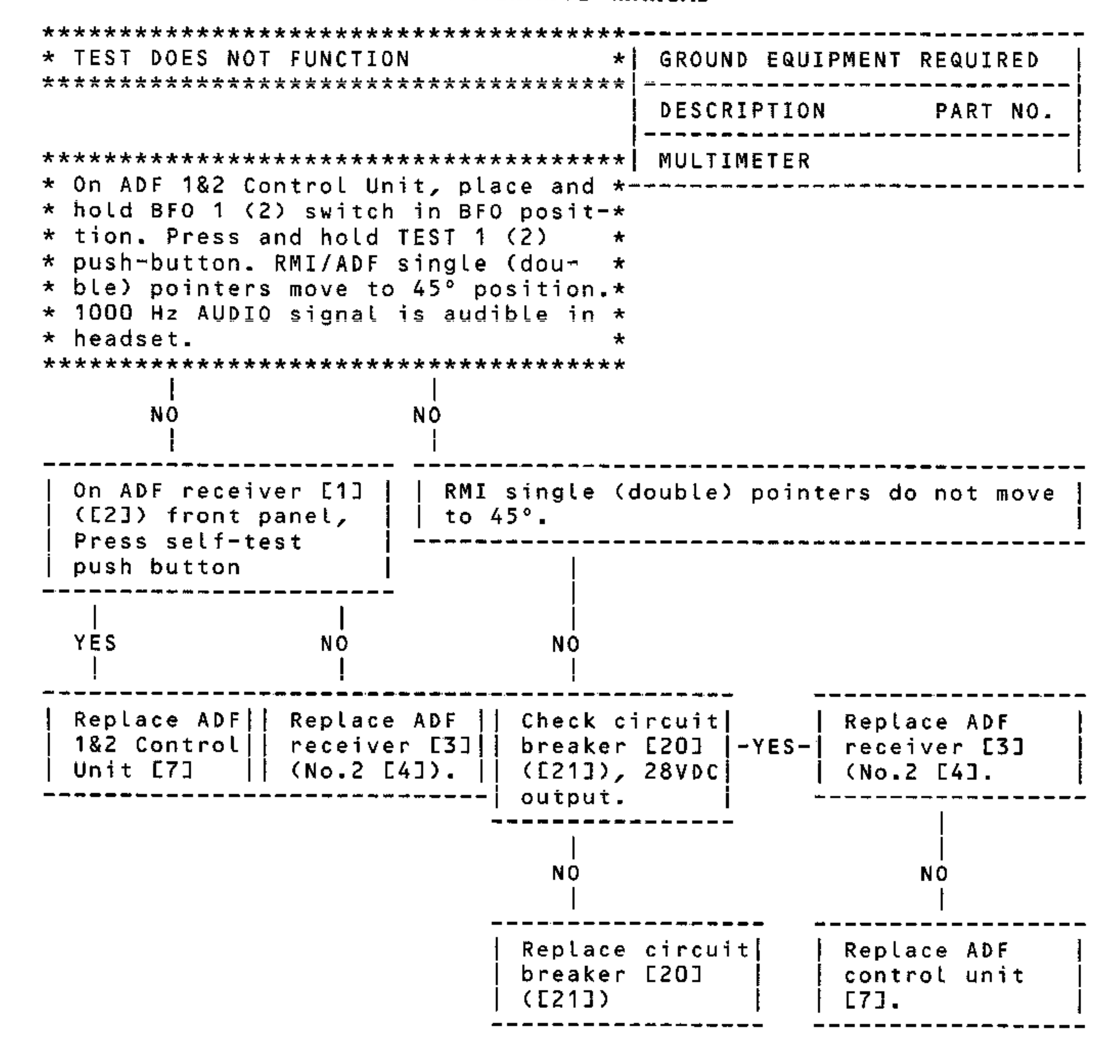

TEST DOES NOT FUNCTION
GROUND EQUIPMENT REQUIRED
DESCRIPTION
PART NO.
MULTIMETER
On ADF 1&2 Control Unit, place and hold BFO 1 (2) switch in BFO position. Press and hold TEST 1 (2) push-button. RMI/ADF single (double) pointers move to 45° position. 1000 Hz AUDIO signal is audible in headset.
NO
NO
On ADF receiver [1] ([2]) front panel, Press self-test push button
RMI single (double) pointers do not move to 45°.
YES
NO
NO
Replace ADF 1&2 Control Unit [7]
Replace ADF receiver [3] (No.2 [4]).
Check circuit breaker [20] ([21]), 28VDC output.
-YES-
Replace ADF receiver [3] (No.2 [4].
NO
NO
Replace circuit breaker [20] ([21])
Replace ADF control unit [7].

Chart 101

	ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
R	[1] Captain RMI/ADF		2-211	1R182	Flt. Cpt	34-53-21 R/I	34-53-01
R	[2] 1st OFF RMI/ADF		2-212	2R182	Flt. Cpt	34-53-21 R/I	34-53-01
R	[3] ADF receiver No.1	244GS	1-244	1R167	Rear Electronics Rack	34-53-12 R/I	34-53-01
R	[4] ADF receiver No.2	244GS	1-244	2R167	Rear Electronics Rack	34-53-12 R/I	34-53-05
	[5] Breaker 26VAC		2-213	1R174	Map ref C7	24-50-00	34-53-01
	[6] Breaker 26VAC		13-216	2R174	Map ref A18	24-50-00	34-53-05
R	[7] ADF 1&2 Control Unit		9-211	R168	Flt Cpt	34-53-32 R/I	34-53-01
	[8] Sense Antenna	231CT	231	1R169	Top Fuselage	34-53-14 R/I	34-53-01
	[9] Sense Antenna	231CT	231	2R169	Top Fuselage	34-53-14 R/I	34-53-05
	[10] Antenna Coupler		231	1R170	Under Fuselage	34-53-14 R/I	34-53-01
	[11] Antenna Coupler		231	2R170	Under Fuselage	34-53-14 R/I	34-53-05
	[12] Sense cable equalizer		7-244	1R181	Under Fuselage	34-53-14 R/I	34-53-01
	[13] Sense cable equalizer		7-244	2R181	Under Fuselage	34-53-14 R/I	34-53-05
	[14] Loop antenna 1		234	1R171	Top Fuselage	34-53-11 R/I	34-53-01

ITEM No. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
[15] Loop antenna 2		234	2R171	Top Fuselage	34-53-11 R/I	34-53-05
[16] Quadrantal error corrector 1		234	1R172	Under Fuselage	34-53-11 R/I	34-53-01
[17] Quadrantal error corrector 2		234	2R172	Under Fuselage	34-53-11 R/I	34-53-05
[18] Cable assy		234	1R178	Under Fuselage	34-53-11 R/I	34-53-01
[19] Cable assy		234	2R178	Under Fuselage	34-53-11 R/I	34-53-05
[20] Breaker 28VDC		1-213	1R173	Map ref H15	24-50-00 R/I	34-53-01
[21] Breaker 28VDC		15-216	2R173	Map ref B21	24-50-00 R/I	34-53-05

Component Identification
Table 101

AUTOMATIC DIRECTION FINDING (ADF) - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	TE2037000
1 Headset (from test set)	

B. Prepare

(1) On Captain jack panel, make certain that a boomset is available or connect a headset to HEADSET jack.

(a) On Captain audio selector panel :
- Place R/T/INT switch in mid position.
- Release reception/transmission push-buttons, leaving only ADF1 engaged (push-button depressed).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-00-00).

(4) Start up INS1 and INS2 systems (Ref. 34-45-00, Adjustment/Test).

(5) Switch on compass couplers (Ref. 34-21-00, Adjustment/Test).

(6) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADF1 SUP	1-213	1R 173	H15
No.1 INPH SUP		R 89	K19
ADF1 IND	2-213	1R 174	C 7
FLT CONT & NAV BUS 14XS		X 355	H 2
No.2 INPH SUP	3-213	R 90	H 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH DASH INST LTS SUP		L 372	A12
ADF2 SUP	13-216	2R 174	A18
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 4
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8
ADF2 SUP	15-216	2R 173	B21

C. Test

(1) ADF1 Self-test.

(a) On ADF control unit place BFO1 switch in BFO position.

(b) Press and hold ADF1 TEST push-button
- Make certain that 100Hz signal is audible in headset.
- RMI/ADF single pointers are in 45° position.

(c) Release TEST1 push-button, place BFO switch in 1 position, check that RMI/ADF single pointers return to previous magnetic bearing.

(2) ADF1 Mode test.

(a) On ADF control unit, BFO1 switch is in 1 position.

(b) Select and identify a known local station at ADF1 side.

(c) Captain and First Officer RMI/ADF single pointers move to indicate magnetic bearing of known local station. Station call sign is still audible.

(3) Check of Captain and First Officer RMI lighting.

(a) On LH side console by means of LH DASH INSTRUMENTS selector switch (L382). Check progressive illumination and extinguishing of Captain RMI/ADF lighting.

(b) On RH side console, by means of RH DASH INSTRU-

MENTS selector switch (L381). Check progressive illumination and extinguishing of First Officer RMI/ADF lighting.

(4) Check of ADF control unit lighting.

(a) Panel 9-211, on ADF control unit, check illumination of frequency display windows. Vary illumination brightness by means of Centre Console Panel light switch (L383).

(b) On ADF1 control unit place ADF1 function selector switch in OFF position.

(5) ADF2 test.

(a) Repeat ADF1 test.

(b) On Captain audio selector panel release reception selection push-button ADF1, engage ADF2 reception push-button.

(c) For test procedure read ADF2, BFO switch in 2 position, RMI/ADF double pointers.

(6) Close-up

(a) Replace BFO2 selector on ADF control unit in BFO position.

(b) Release ADF2 reception selection push-button on Captain audio selector panel.

(c) Switch off INS systems (Ref. 34-45-00, Adjustment/Test).

(d) Switch off compass couplers (Ref. 34-21-00, Adjustment/Test).

(e) Remove boomset if necessary.

(f) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONTROL & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(g) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	TE2037000
1 Headset (from test set)	

B. Prepare

(1) Repeat Prepare procedure for operational test.

(a) Carry out self-test.

(b) Carry out lighting check.

(2) On each jack panel make certain that a boomset is present or connect a headset to HEADSET jack.

(a) On Captain, First Officer, Flight Engineer and 1st Supernumerary audio selector panels :
- Place RT/INT switch in mid-position.
- Release reception transmission push-buttons, leave only ADF1 push-button engaged (button in).

C. Test

(1) ADF1

(a) Select a known local frequency on ADF1 section of control unit, place BFO1 switch in 1 position, check station call sign.
On audio selector panel adjust ADF1 volume potentiometer to check that its action is progressive and without cracking. Adjust volume to desired level.
Place BFO1 switch in BFO position, check in headset that 1000 Hz tone is interrupted.
Replace BFO switch in 1 position.

(b) On audio selector panel, engage VOICE push-button which illuminates. Check in headset that 1000 Hz tone is interrupted. Release VOICE push-button.

(c) Repeat reception adjustment on the other three audio selector panels.

(d) On Captain and First Officer RMI, COMPASS flag is not visible, heading dials indicate aircraft magnetic heading. Check that single-pointer indicates magnetic bearing of the known local station.

(e) Select in each of the following frequency bands a known local frequency :

BAND IN KHz	FREQUENCY IN KHz	STATION	CALL SIGN
190-399.5			
400-700.5	ACCORDING TO LOCATION OF AIRCRAFT		
800-1799.5			

(f) Successively select frequency chosen in each band, verify call sign and check station magnetic bearing.

(2) ADF2

(a) Repeat ADF1 test.

(b) Release ADF2 reception push-button on audio selector panel.

(c) For test procedure read ADF2, BFO switch in 2 position, RMI/ADF double pointer.

D. Close-Up

Repeat Close-Up procedure in operational test, paragraph (6).

3. System Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
1 Headset (from test set)	
1 Q meter	

B. Prepare

(1) Repeat Prepare procedure for operational test.

C. Test

(1) Repeat operational test.

(2) Sense antenna capacitance measurements.

(a) ADF1 sense antenna
- On antenna coupler (1R170), zone 231-1, disconnect cable 1R177A from ANT terminal in order to connect cable to Q meter capacitance terminal
- By means of Q meter, carry out antenna 1R169 capacitance measurement (value obtained must be 150 ± 15 pF.).
- Disconnect antenna cable from Q meter and reconnect to ANT terminal on coupler.

(b) ADF2 sense antenna
- On antenna coupler (2R170) zone 231-1, disconnect cable 2R177A from ANT terminal in order to connect cable to Q meter capacitance terminal
- By means of Q meter, carry out antenna 2R169 capacitance measurement (value obtained must be 150 ± 15 pF.).
- Disconnect antenna cable from Q meter and reconnect to ANT terminal on coupler.

(3) Repeat functional test at end of test keep both systems on identical frequencies.

(4) Interference check between ADF systems.

(a) On Captain audio selector panel check that ADF1 and ADF2 reception is not disturbed.

(b) Repeat this operation on the other three audio

selector panels, First Officer, Flight Engineer and First Supernumerary.

(c) On Captain and First Officer RMI/ADF check that magnetic bearings indicated are identical, single and double pointers superposed and steady.

(d) Locate a different station on ADF2 and repeat above check (a).

D. Close-Up

Repeat Close-Up procedure for operational test.

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AUTOMATIC DIRECTION FINDING (ADF) LOOP ANTENNA
REMOVAL/INSTALLATION

1. General

The ADF loop antennas are installed in forward, centre and aft fairings on top of the fuselage, aligned with the aircraft longitudinal axis. Each loop antenna is equipped with a quadrantal error corrector and is mounted on a support fitted with a collar, the aperture of which enables connections to be made and provides a housing for the quadrantal error corrector inside the fuselage. ADF1 loop antenna is located forward of loop antenna No. 2 between frames 62 and 63. ADF2 loop antenna is located between frames 64 and 65. Removal/Installation procedure is similar for both antennas and only the Removal/Installation of ADF1 (1R171) loop antenna will be described.

2. ADF Loop Antenna

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform to top of fuselage Height of Access 7.02 m (23 ft)	
Circuit Breaker Safety Clips	
R Sealants (Ref. 20-30-00, No.351)	PR 1720SM

B. Prepare

(1) Position access platform so as to gain access to top of fuselage.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADF1 SUP	1-213	1R 173	H15
ADF1 IND	2-213	1R 174	C 7
ADF2 IND	13-216	2R 174	A18
R ADF2 SUP	15-216	2R 173	B21

C. Remove (Ref. Fig. 401)

(1) On ADF1 loop antenna, loosen the 11 mounting screws on upper part of fin.

(2) Place reference marks on the 11 screws to identify their position and length. Remove screws.

(3) Lift rear part of antenna approximately 80 millimeters the forward part remaining in contact with fuselage (Phase 1).

(4) Turn loop antenna approximately 15° to left until it is possible to raise it 15 millimeters, forward part of loop is raised to level of forward fairing (Phase 2).

(5) Uncouple quadrantal error corrector by disconnecting screw connector (Phase 3).

(6) Remove loop antenna.

(7) Manually pull quadrantal error corrector upwards, progressively inclining it forwards to 45°. It is then possible to extract it through the collar aperture (Phase 4).

(8) Disconnect corrector from cable and remove.

D. Install

(1) Make certain that replacement loop antenna is in good condition.

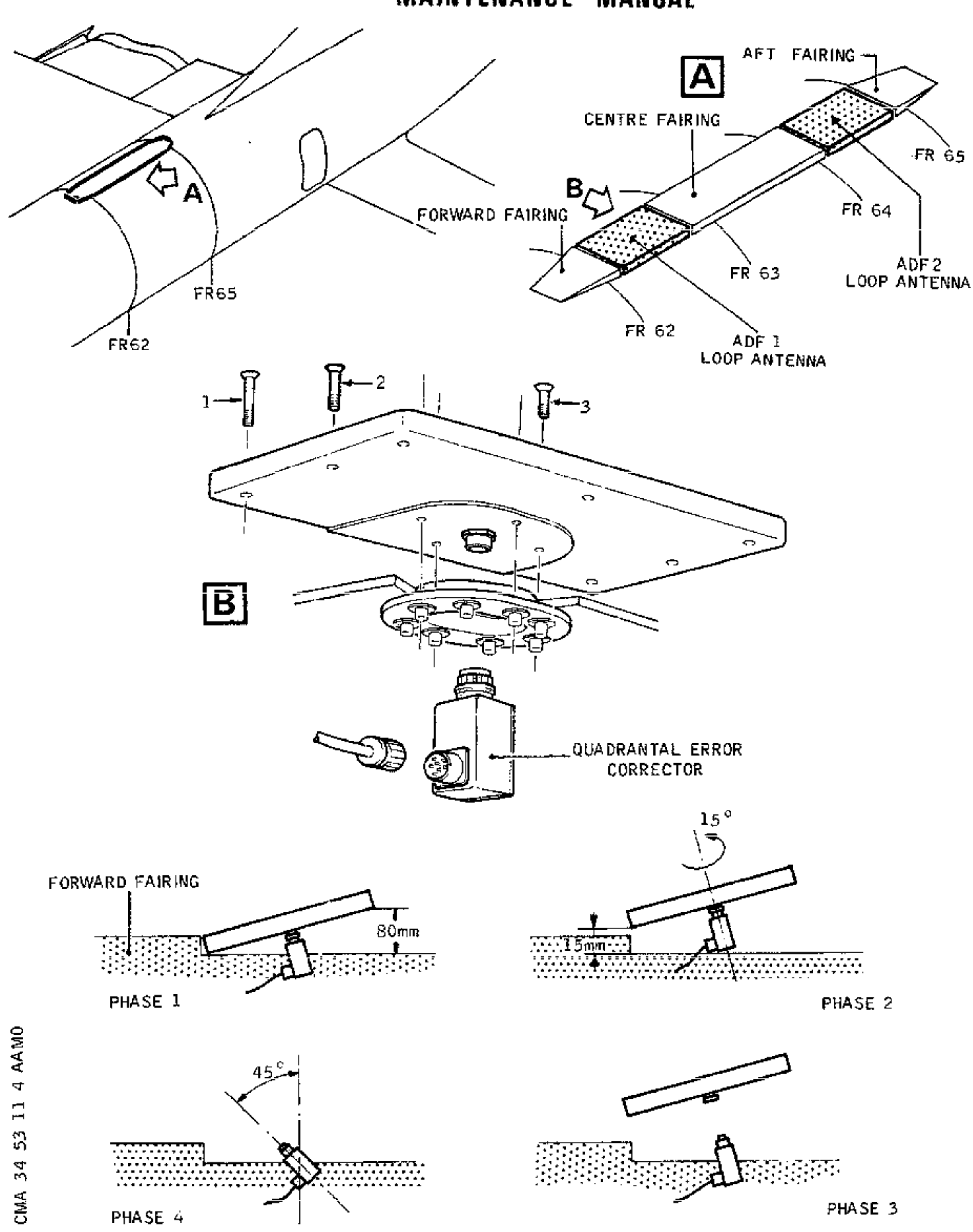
(2) Make certain that seals on base of collar are clean,
R coat with sealant No.351.

(3) Proceeding in a reverse manner from that of removal procedure, assemble loop antenna and quadrantal error corrector, connect cable connector to quadrantal error corrector, position loop antenna assembly on its base.

(4) Secure loop antenna, identifying the screws and their appropriate positions.

E. Tests

(1) Remove safety clips and tags and reset the following circuit breakers :



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Removal Sequence and Replacement
of a Loop Antenna
Figure 401

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADF1 SUP	1-213	1R 173	H15
ADF1 IND	2-213	1R 174	C 7
ADF2 IND	13-216	2R 174	A18
R ADF2 SUP	15-216	2R 173	B21

(2) Carry out an operational test of the system (Ref. 34-53-00, A/T).

F. Close-Up

(1) Remove access platform from working area.

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ADF RECEIVER - REMOVAL/INSTALLATION

1. General

Two ADF receivers 1R167 and 2R167 are located side by side in RH aft electronics rack on shelf 1-244.

2. ADF Receiver

NOTE : As both receivers are identically installed only one removal/installation procedure is described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps for Electrical Connectors	
Blanking Plates for Ventilation Outlets	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADF1 SUP	1-213	1R 173	H15
ADF1 IND	2-213	1R 174	C 7
FLT CONT & NAV BUS 14XS		X 355	H 2
ADF2 IND	13-216	2R 174	A18
NAV INST BUS 13XS		X 345	G 4
ADF2 SUP	15-216	2R 173	B21

(2) Remove panel 244GS to gain access to shelf 1-244.

C. Remove

(1) Refer to 24-00-00, Removal/Installation, paragraph 2.D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

F. Test

(1) Remove safety clips and tags and reset circuit breakers tripped in paragraph 2.B.(1).

(2) Carry out test of ADF receiver(s) (Ref. 34-53-12, Adjustment/Test).

G. Close-Up

(1) Install panel 244GS on RH aft electronics rack.

ADF RECEIVER - ADJUSTMENT/TEST

1. General

Check correct operation of ADF receiver(s) after removal/installation.

2. ADF Receiver

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Operate electronics rack ventilation (Ref. 21-21-00).

C. Test

(1) In RH aft electronics rack, shelf 1-244, on ADF receiver front panel, press test push-button.
- bearing indicator on receiver front panel indicates 45°,
- release test push-button.

D. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14xS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00,

Servicing).

SENSE ANTENNA - REMOVAL/INSTALLATION

1. General

Removal for check of aircraft structure under antennas.
The sense antennas are installed in zone 231 between frames 48-52 (antenna 1R169) and in zone 233 between frames 53-57 (antenna 2R169).
The antennas consist of metal gauze sheets embedded in laminated coverings and are connected to the inputs of ADF receivers 1R167 and 2R167 respectively via couplers 1R170 and 2R170 and by means of adaptor lines 1R177 and 2R177.

CAUTION : FLUX VALVE BEING HIGHLY SENSITIVE TO MAGNETIC INTERFERENCE, INSTALLATION AND REPLACEMENT MUST BE DONE WITH NON MAGNETIC PARTS OR TOOLS.

2. Sense Antenna

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform, Height of Access 6m670 (21 ft. 11 in.)	
Circuit Breaker Safety Clips	
Non-magnetic Tools	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADF1 SUP	1-213	1R173	H15
ADF1 IND	2-213	1R174	C7
ADF2 IND	13-216	2R174	A18
ADF2 SUP	15-216	2R173	B21

(2) Position access platform to reach top of fuselage.

C. Remove (Ref. Fig. 401)

(1) Remove 5 attachment screws (3 screws at sides and 2 at top) from access door 231CT (6), open door.

(2) Remove 30 screws (1) from sides of sense antennas 1R169 or 2R169 (2), then remove 2 upper screws (3).

(3) On antenna coupler "susceptiformer" terminal 1R170 or 2R170 (5), remove antenna feeder cable (4) securing nut and remove cable from terminal.

(4) Remove sense antenna (2).

(5) Clean surface of structure at antenna mounting position

(6) If sense antenna assembly is to be replaced, remove antenna feeder cable.

D. Preparation of Replacement Component

(1) Make certain that the sense antenna fairing is in good condition (absence of cracks and scratches---).

(2) Connect antenna feeder cable.

E. Install

(1) Install sense antenna (2).

(2) On antenna coupler terminal 1R170 or 2R170 (5), connect antenna feeder cable (4), install securing nut and torque to 8 lb. in. (0.090 m.daN).

(3) Install the two upper screws (3), then the 30 side screws (1). Tighten screws.

F. Test

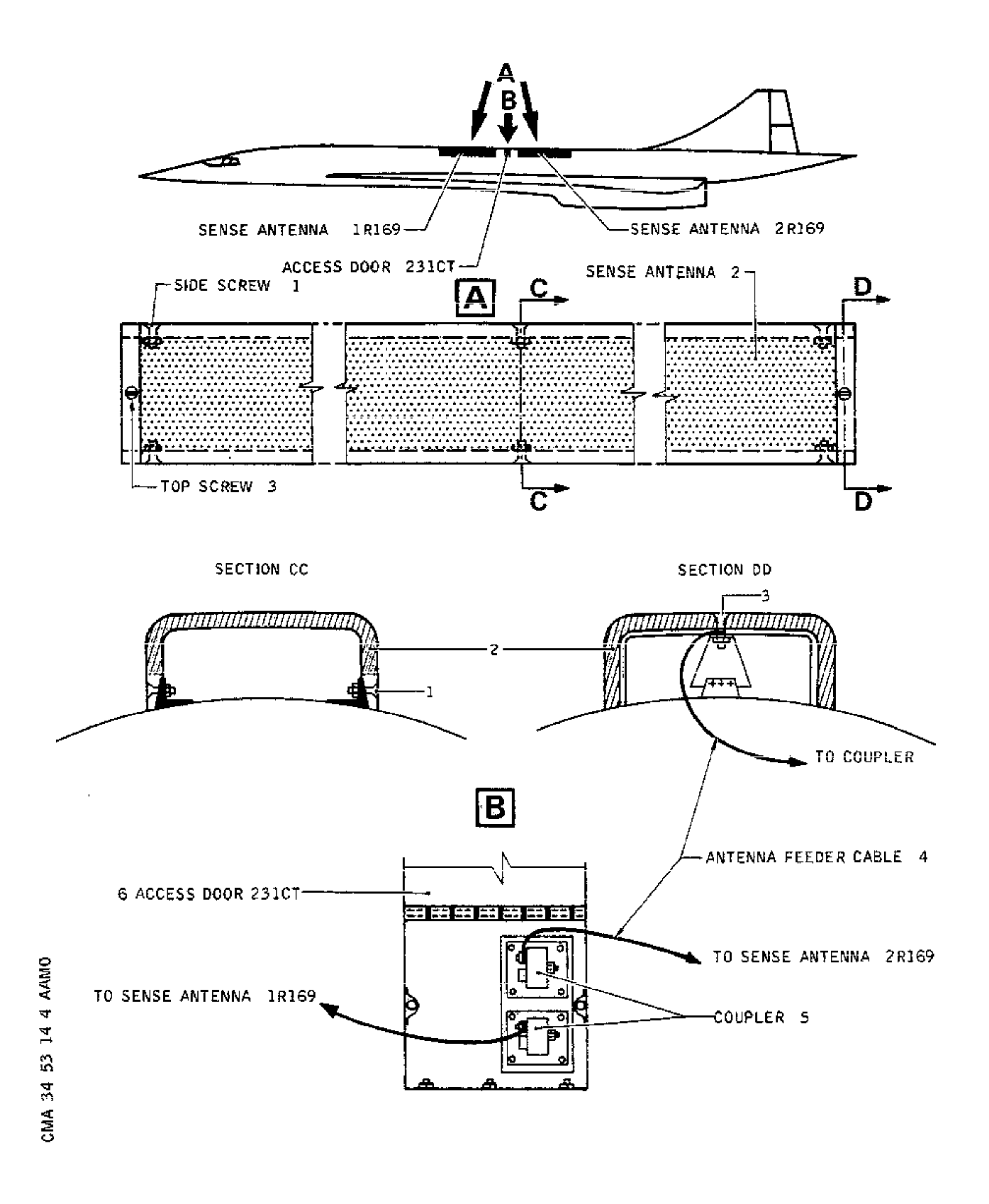
(1) Remove safety clips and tags from circuit breakers listed in paragraph 2-B-(1), reset circuit breakers.

(2) Carry out Prepare procedure described in operational test (Ref. 34-53-00, Adjustment/Test).

(3) On ADF control unit, select a known local frequency (ADF mode) and check on the RMI/ADF indicators that :

- Compass flag is not visible.
- Heading dials indicate aircraft magnetic heading.
- Single pointer indicates magnetic bearing of known

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Sense Antenna - Removal/Installation
Figure 401

local station.

(4) Carry out Close-up procedure described in operational test. (Ref. 34-53-00, Adjustment/Test).

G. Close-up

(1) Close access door 231CT.

(2) Install and tighten five securing screws.

(3) Remove access platform.

3. "Susceptiformer" coupler

A. Equipment and Materials

Ref. paragraph 2A.

B. Prepare

Repeat operations in paragraph 2B.

C. Remove (Ref. Fig. 402)

(1) Remove 5 attachment screws (3 screws at sides and 2 at top) from access door 231CT, open door.

(2) On antenna coupler 1R170 or 2R170 (3) disconnect :

- coaxial connector (6) from adaptor line (7)
- antenna feeder cable (5) from its terminal after removal of securing nut
- ground lead (4) from its terminal after removal of securing nut.

(3) Remove the four antenna coupler (3) securing screws (1) [of which 3 are fitted with cable clamps] from mounting (2).

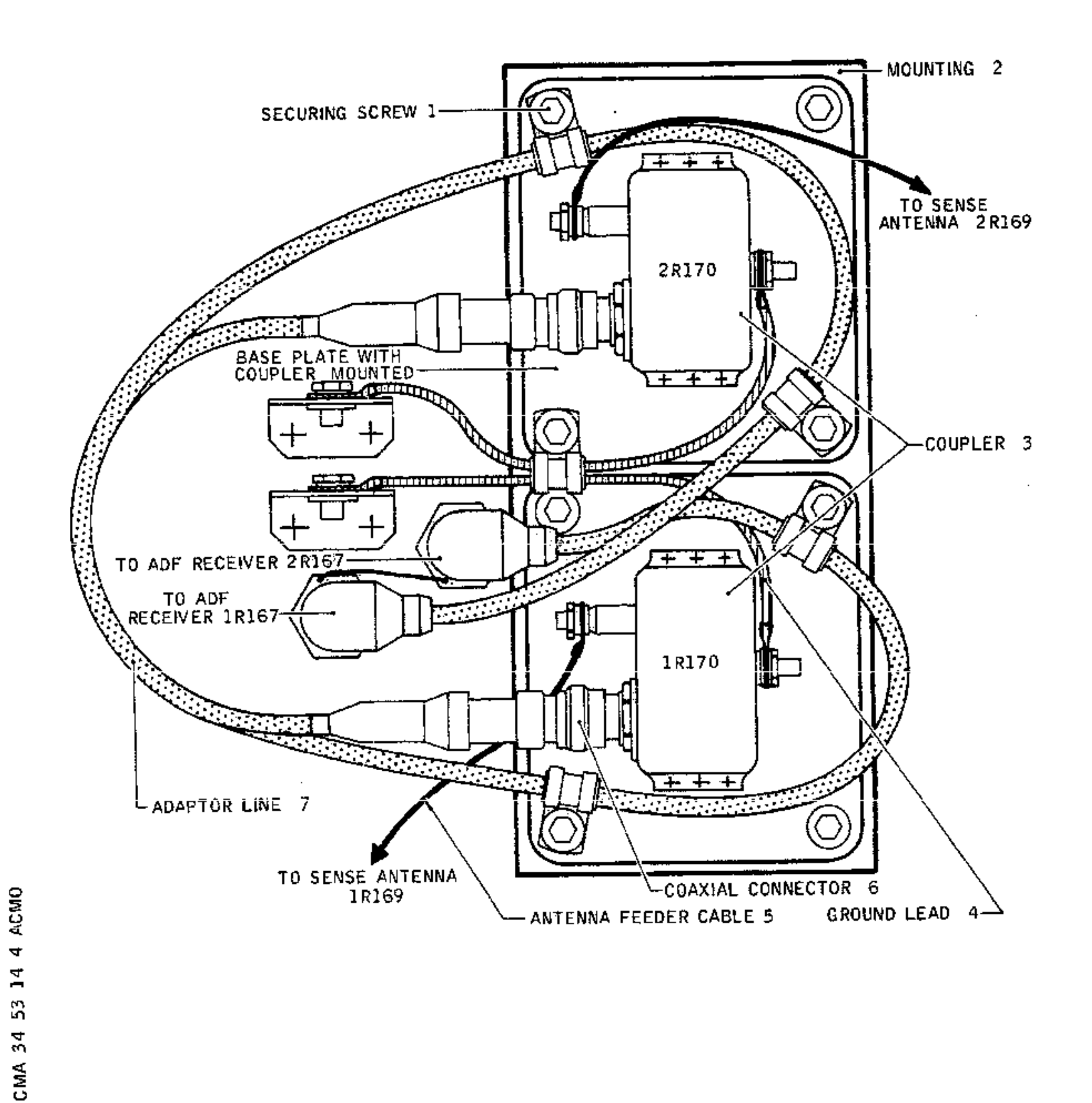
(4) Remove coupler mounted on its baseplate.

(5) On mounting (2) clean antenna coupler baseplate mounting area.

D. Preparation of Replacement Component

(1) Visually check that :

- the coupler is securely riveted to its baseplate
- connection terminals are in good condition (threads,



CMA 34 53 14 4 ACMO

"Susceptiformer" Antenna Coupler - Removal/
Installation
Figure 402

no trace of corrosion--------).
- coaxial connector is not oxydized and its pins are in good condition.

E. Install

(1) Position coupler (3) and its baseplate on mounting (2).

(2) Install the four securing screws (1) [3 fitted with cable clamps], tighten screws.

(3) On coupler (3) connect :

- adaptor line (7) coaxial connector (6)
- antenna feeder cable (5) to its terminal, install securing nut and torque to 8 lb. in. (0.090 m.daN).
- ground lead (4) to its terminal, install securing nut and torque to 8 lb. in. (0.090 m.daN).

F. Test

Repeat operations in paragraph 2F.

G. Close-up

Repeat operations in paragraph 2G.

RMI/ADF INDICATOR - REMOVAL/INSTALLATION

1. General

Two indicators are installed, on the Captain (2-211) and First Officer (2-212) instrument panels. The indicators cannot be directly withdrawn from the front of the instrument panels because of insufficient wiring length.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On LH and RH side panels 12-211 and 5-212 make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYST 1 SW SUP	1-213	1F 134	F14
ADF 1 SUP		1R 173	H15
ADF 1 IND	2-213	1R 174	C 7
COMPASS COUPLER 1 SUP		1F 130	F 8
FLT CONT & NAV BUS 14XS		X 355	H 2
LH DASH INST LTS SUP	13-215	L 372	A12
COMPASS COUPLER 2 STB		2F 131	B 7
ADF 2 IND	13-216	2R 174	A18
COMPASS COUPLER 2 NORMAL SUP		2F 130	D15
RH DASH INST LTS SUP		L 371	E 9
NAV INST BUS 13XS		X 345	G 3

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER 2 SYS 2 SW SUP	15-216	2F 134	A21
ADF 2 SUP		2R 173	B21

C. Remove (Ref. Fig. 401)

(1) Loosen and remove the four adaptor plate (3) mounting screws (4).

(2) Remove adaptor plate (3).

(3) Carefully remove RMI/ADF indicator (2) from its seating (8). Support indicator.

(4) Under instrument panel, disconnect connector (7) from indicator.

(5) Withdraw indicator (2).

(6) Cap connectors (6) and (7).

D. Preparation of Replacement Component

(1) Make certain that indicator seating is clean and that connectors and aircraft wiring are in correct condition.

(2) Make certain that indicator is in correct external condition, that connectors are undamaged and have no traces of corrosion.

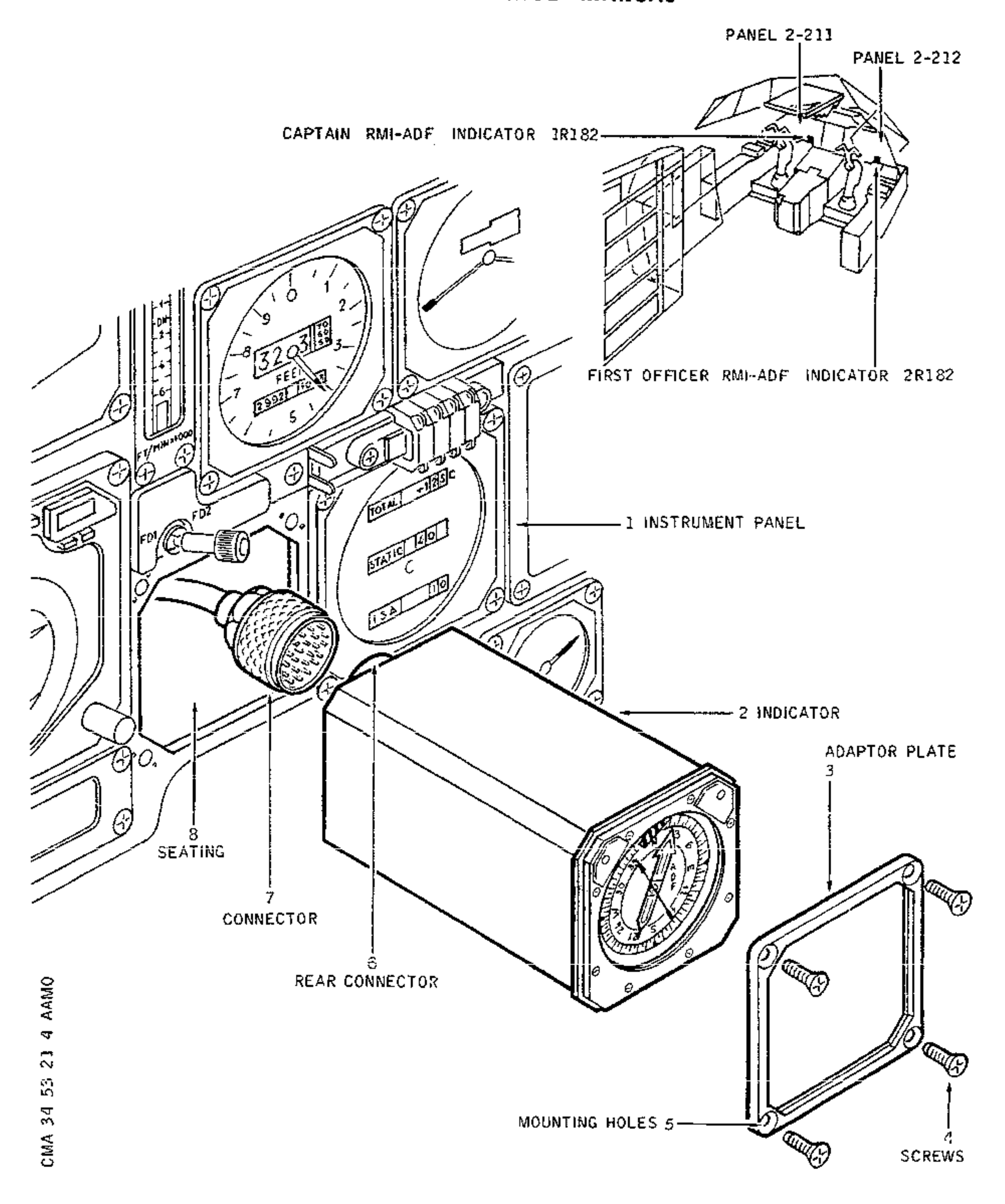
E. Install
R (Ref. Fig. 401)

(1) Remove blanking caps from connectors (6) and (7).

(2) Position indicator (2) facing its seating (8) and carefully install.

(3) Under instrument panel, connect aircraft connector (7) to indicator receptacle (6).

(4) Push indicator (2) fully against instrument panel (1).



Removal/Installation of an RMI/ADF Indicator
Figure 401

(5) Position adaptor plate (3) and install and tighten mounting screws (4) in adaptor plate holes (5).

F. Tests

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2. B. (2).

(2) Connect electrical-ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch an electronics rack ventilation system (Ref. 21-21-00).

(4) Adjust LH DASH INSTRUMENTS, panel 12-211 or RH DASH INSTRUMENTS, panel 5-212 potentiometer to obtain correct illumination of indicator face.

(5) On centre console 9-211, ADF control unit, carry out self-test and check that single pointer on RMI/ADF indicators is positioned at 45°.

(6) Terminate self-test, single-pointer on RMI/ADF indicators returns to initial position.

G. Close-Up

(1) On panels 12-211 and 5-212 place LH and RH DASH INSTRUMENTS potentiometers in OFF position.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

ADF CONTROLLER - REMOVAL/INSTALLATION

1. General

Dual ADF controller (R168) is located in the flight compartment, on centre console 9-211.

2. ADF Controller

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Plugs/Caps	

B. Prepare

(1) On overhead panel 4-211 make certain that CENTRE CONSOLE PANEL switch is in OFF position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ADF1 SUP	1-213	1R 173	H15
ADF1 IND	2-213	1R 174	C 7
FLT CONT & NAV BUS 14XS		X 355	H 2
ADF2 IND	13-216	2R 174	A18
NAV INST BUS 13XS		X 345	G 4
CTR CONSOLE INST LTS SUP	14-216	L 405	B 8
ADF2 SUP	15-216	2R 173	B21

C. Remove

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.F.

F. Close-Up

(1) Remove safety clips and tags and reset the circuit breakers tripped in paragraph 2.B.(2).

(2) Carry out operational test of ADF system (Ref. 34-53-00, Adjustment/Test).

END OF THIS SECTION

NEXT

VHF/OMNIRANGE - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

   The VOR (VHF omnirange) system is a radio aid designed to increase navigational precision.

   It is based on two factors :

   - 360° coverage by the radials transmitted by the VOR ground station.
   - Capability of the aircraft equipment to translate this position information into visual information.

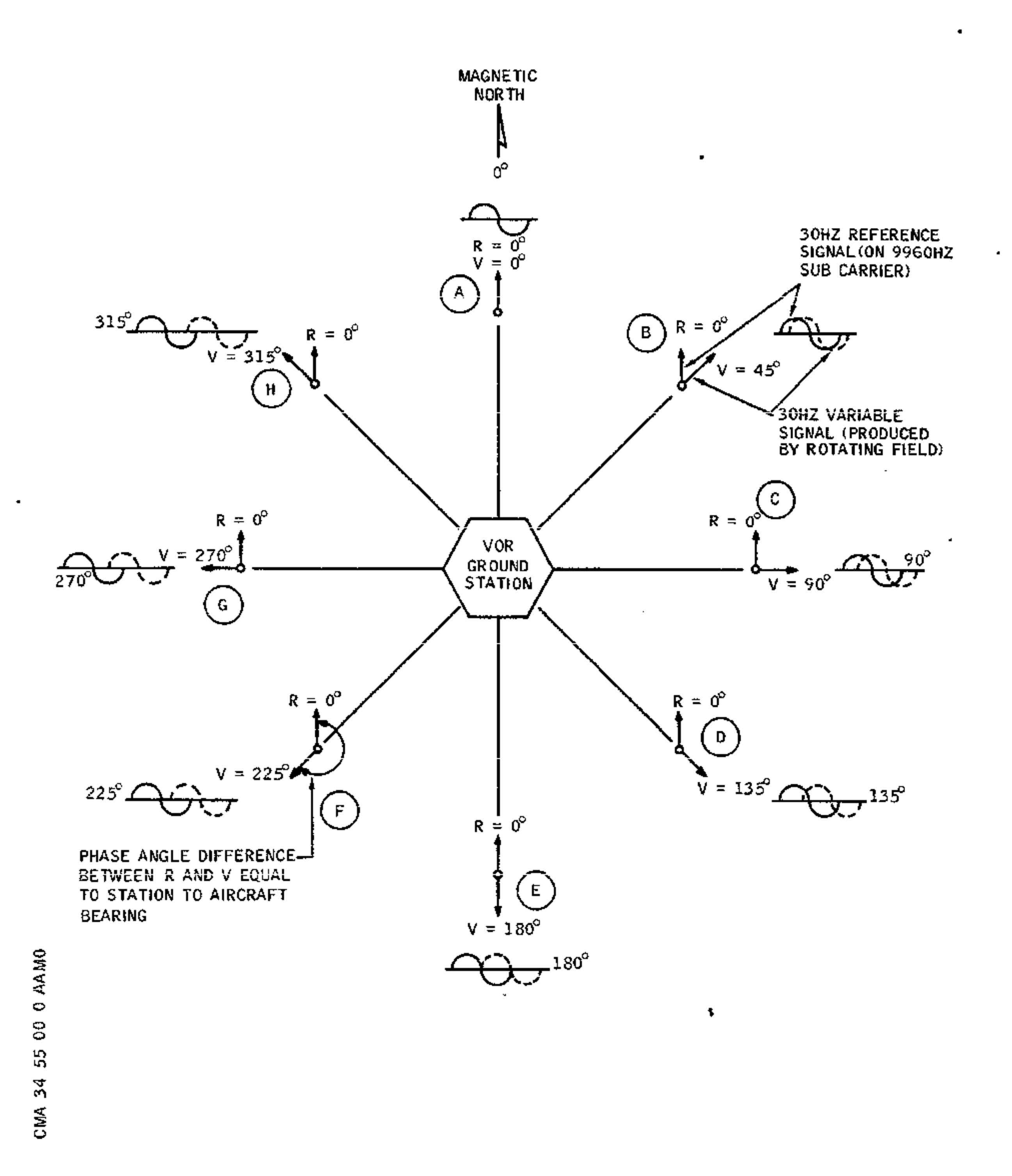
   NOTE : The term Radial defines the angle between magnetic north and the aircraft, measured from the VOR station.

   The basic VOR principle is the measurement of the phase difference between two 30 Hz signals transmitted by the VOR station. These transmitter signals are radiated by a five element antenna device designed to produce a composite space modulated signal. One of the transmitted 30 Hz signals is designated the reference phase signal. The second 30 Hz signal transmitted is the variable phase signal. The omnidirectional reference phase signal is radiated by the central fixed element. The variable phase signal is radiated by the four diagonal elements of the antenna rotating at 30 revolutions per second, clockwise.

   The reference phase signal is a VHF signal, amplitude modulated by a sub-carrier of 9960 Hz, which is itself frequency modulated by a 30 Hz signal, and which has a deviation of ± 480 Hz.

   By convention, the frequency modulated sub-carrier is at its maximum value at magnetic north, 9960 + 480 = 10440 Hz positive modulation. The modulated frequency decreases to a minimum at 180°, the sub-carrier frequency is then 9960 - 480 = 9480 Hz. It passes through its mean value of 9960 Hz at the 90° and 270° points. As seen by a frequency demodulator in a receiver, the 30 Hz reference signal follows this pattern.

   The variable phase signal amplitude modulates the VHF carrier by means of the rotation of the 4 dipoles which produce a field of 4 lobes with 90° spacing. The maximum field intensity is referenced to magnetic north, occurring upon the passage of each dipole. The assembly turns around the fixed element at 30 revolutions per second. The resultant field is of cardioid form rotating at 30 revolutions per second. Space modulation of the cardioid introduces amplitude modulation of the carrier signal and this is the 30 Hz variable phase signal. The phase of the variable phase and reference phase signals are conventionally



Radial Characteristics
Signal Phase Relationships
Figure 001

referenced to magnetic north, that is, the phase difference between reference phase and variable phase signals is zero. This radial information enables identification, in automatic VOR operation, of the radial on which the aircraft is flying.

The 9960 Hz subcarrier is also amplitude modulated by a 1020 Hz signal, or by voice signals, the audio tone signal is used for ground station identification, the voice signals for transmission of navigational information. The station operates in the VHF band between 108 - 117.95 Hz, at 50 KHz spacing.

2. System Components (Ref. Fig. 002)

The VOR system consists of :

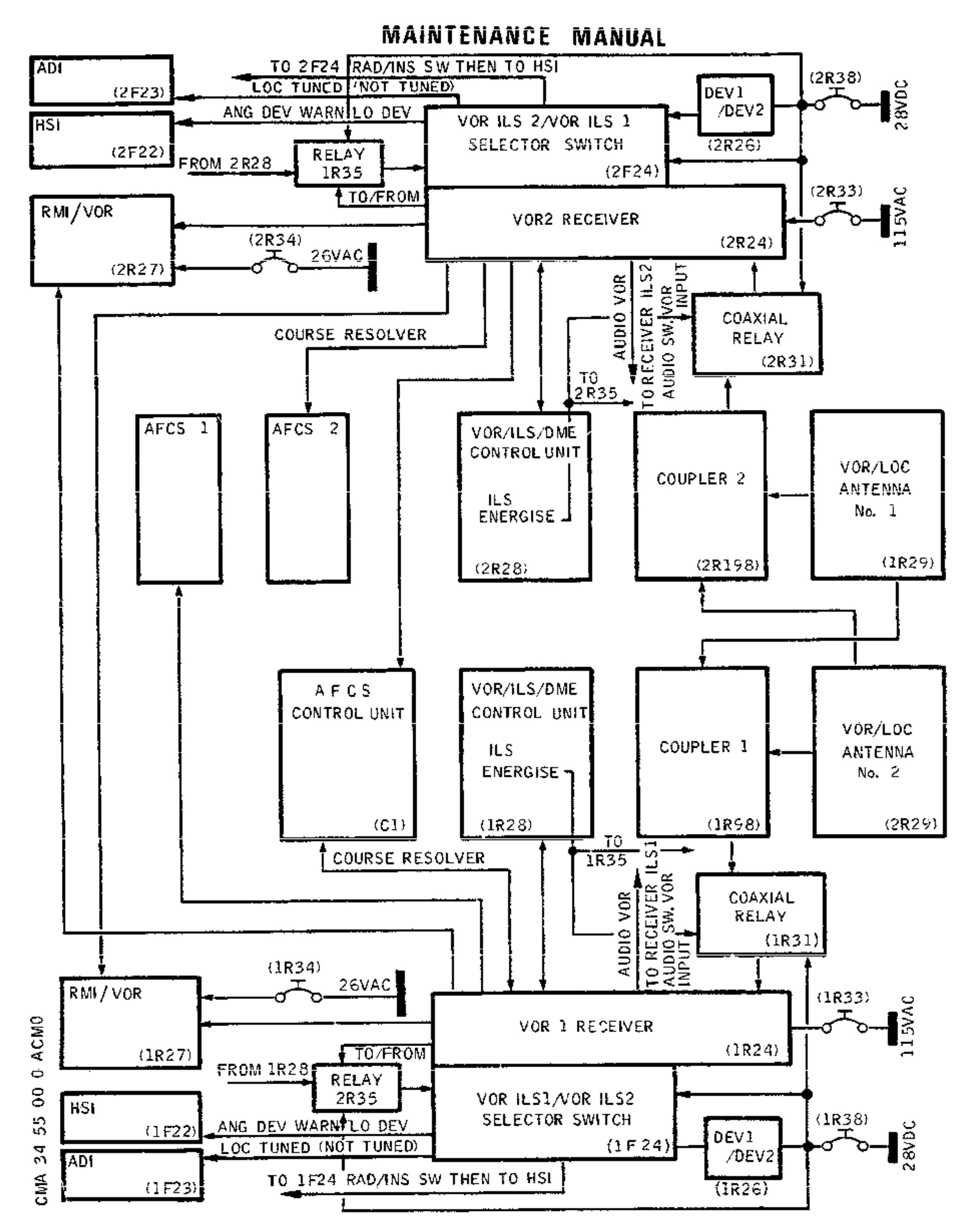
- 2 VOR receivers.
R - 2 VOR/ILS/DME control units
- 2 RMI
- 2 VOR/LOC antennas
- 2 antenna couplers
- 2 antenna coaxial relays
- 2 VOR/ILS selector switches
R - 2 VOR/ILS operation relays
- 2 HSI (these multi-purpose indicators are not specific to the VOR system and also form part of other systems)
- 2DEV1-DEV2 switches (these two-position locking switches, are located on the captain and co-pilot instrument panels, enable switching of the output of either receiver to a selected indicator).

3. Receiver - VOR RVA 33A, PN2070.750.3305, BENDIX (Ref. Fig. 003)

A. Description

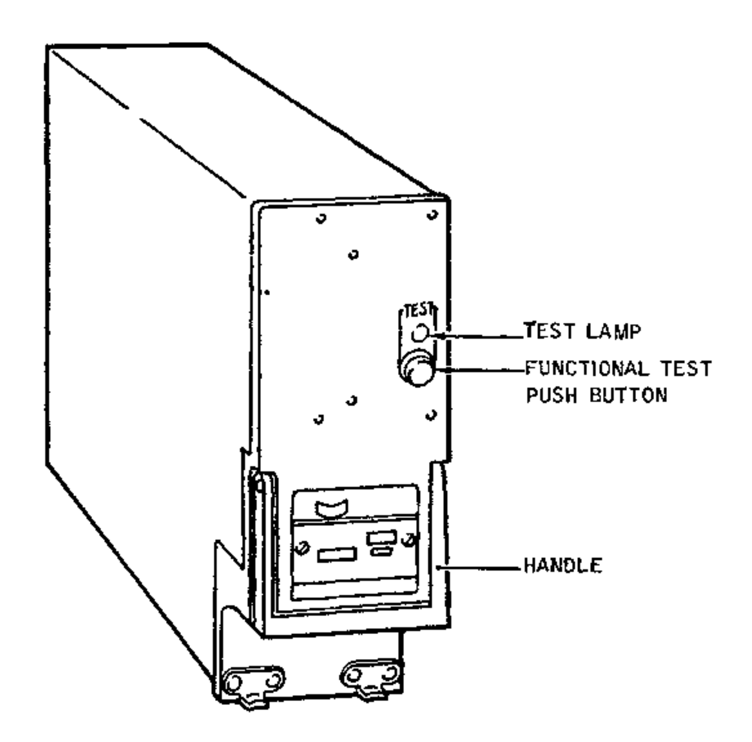
The VOR receiver is a navigation receiver designed to process navigation signals transmitted by VOR ground stations. It operates in the VHF band between 108 and 117.95 MHz, in 160 channels. The signals processed by the receiver enables station identification by means of voice or audio tone signals. The receiver produces information for presentation on the indicators :

- bearing of the VOR station concerned
- deviation from a selected radial
- flight direction indication on the radial (TO or FROM)
- the automatic flight control system also receives guidance deviation information.
  The receiver supplies warning signal voltages to the indicators and navigation systems. It is contained in a 3/8 ATR short case fitted with a carrying handle. On the



VOR : System Block Diagram
Figure 002

R



CMA 34 55 00 0 AEMO

VOR : Receiver, General View
Figure 003

front panel a test push-button with an associated validity indicator light enables maintenance personnel to test receiver performance without removal.
A connector at the rear provides system interconnections.
A connector on the rear upper section enables connection to test equipment. The unit is entirely transistorised, the main frame consists of seven modules :
- VHF receiver
- instrumentation board
- module A, analog bearing processor
- module B, digital processor
- module C, demodulator and DME drive
- module D, digital output
- power supply assembly module

  Connections to these subassemblies are made by coaxial plugs and multi-pin connectors.

B. Operation

Frequency selection is made by the TWO OUT OF FIVE binary code method. Frequency stability is of the order of ± 0.003% from -30 to +70°C. Bearing error is less than

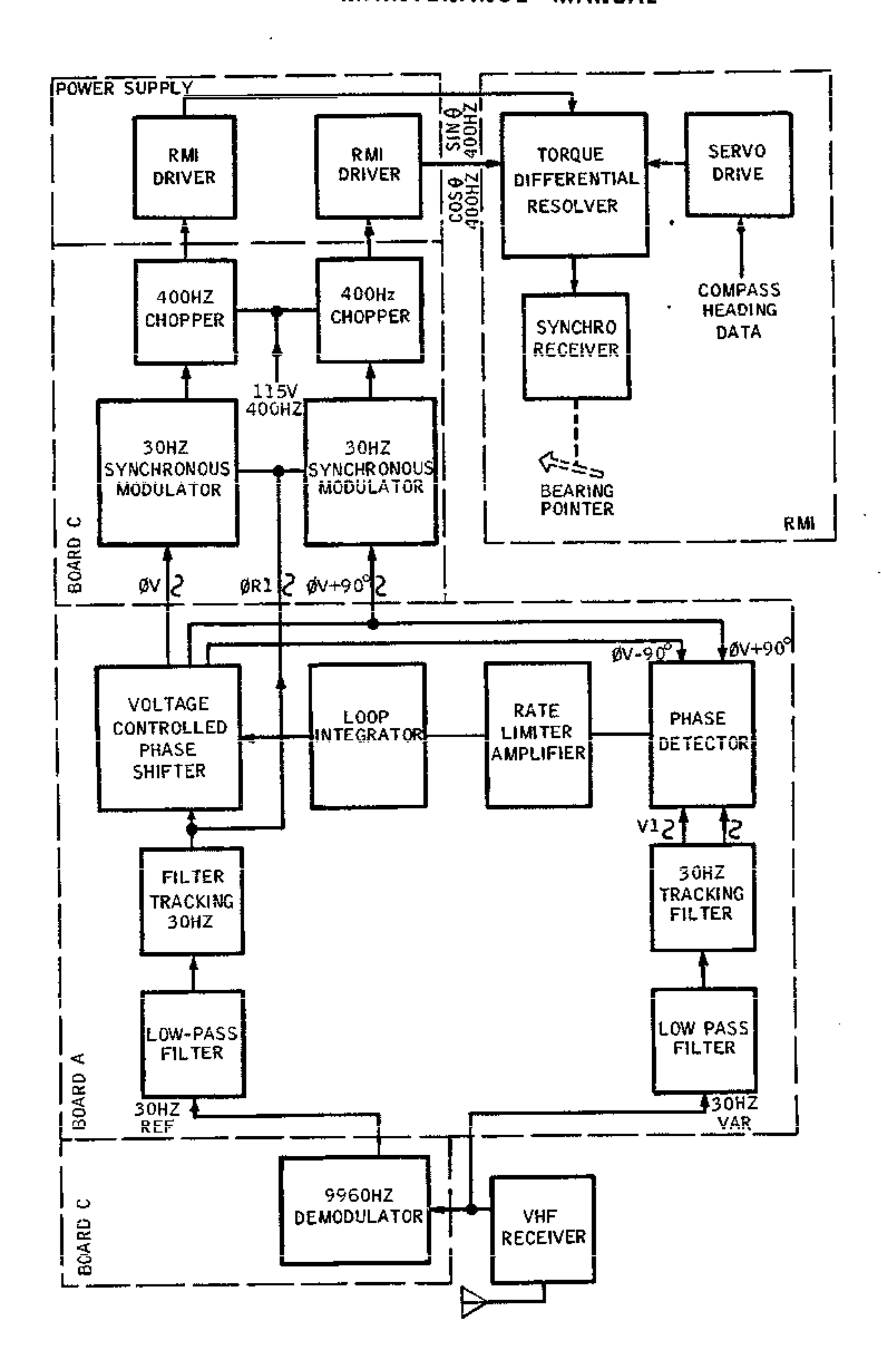
0.5° for digital bearings, less than 0.8° for analog bearings. "Course deviation" stability is ± 1 mile at 150 miles range from the station and of the order of 0.15 mile at 10 miles range or less.

(1) The VHF receiver is a crystal-controlled triple-conversion superheterodyne. The triple antenna circuit is tuned by means of voltage-variable capacitors. The control voltages are supplied from logic circuitry. The mixer stage receives input and local oscillator signals. After mixing, the first IF signal is passed through a filter and applied to the second mixer which also receives the second local oscillator signal. After filtering the second IF signal is sent to the third mixer, which receives the third local oscillator signal.
The third mixer output is filtered and sent to the third IF integrated circuit amplifier. This high gain circuit is transformer coupled to a second integrated circuit IF amplifier. The following detector stage sends the audio-frequency signal to an amplifier stage, the output of which is applied to the output amplifier. The signal is available to the audio system via the output transformer. A NAV output is also available. To produce the AGC voltage, the first audio amplifier output is sent to the AGC stage which supplies a DC voltage to the third IF stage. AGC effectiveness is adjustable by potentiometer.

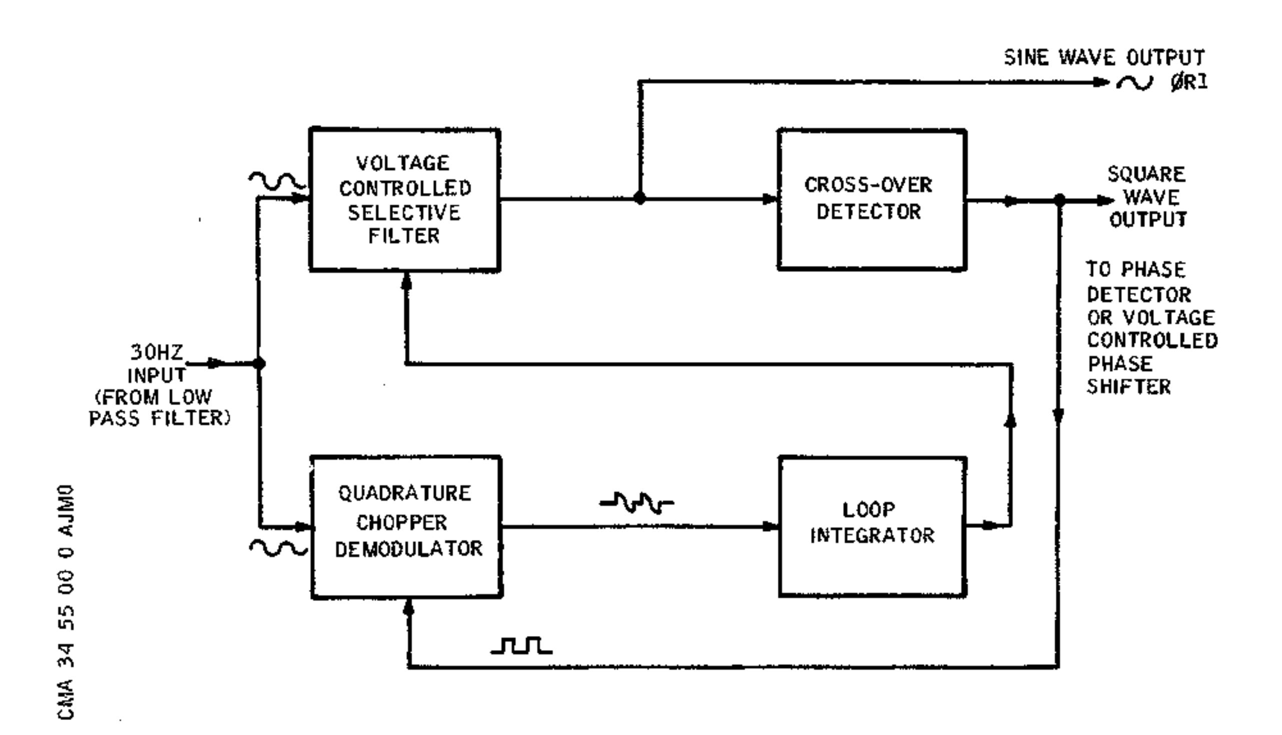
An overload stage comes into operation when a signal in excess of 50,000 microvolts appears at the antenna. This circuit inserts 30 db of attenuation between the antenna and the first mixer. The stage is controlled by the AGC.

(2) Automatic VOR Circuit (Ref. Fig. 004, 005 and 006)

Automatic VOR operation is a term which defines phase difference measurements between the reference phase signal and the variable phase signal. This measurement contains continuous information of the bearing of the VOR ground station which is presented on the R.M.I. (radio magnetic indicators). In automatic VOR operation, as in manual VOR operation, the composite signal, 9960 Hz subcarrier, frequency modulated at 30 Hz, is demodulated (reference phase), and the 30 Hz amplitude modulation signal from NAV output (variable phase) are applied to module A, analog bearing processor via two identical low-pass filters, with sharp cut-off characteristics above 30 Hz. The outputs are processed in two identical 30 Hz tracking filter stages. These

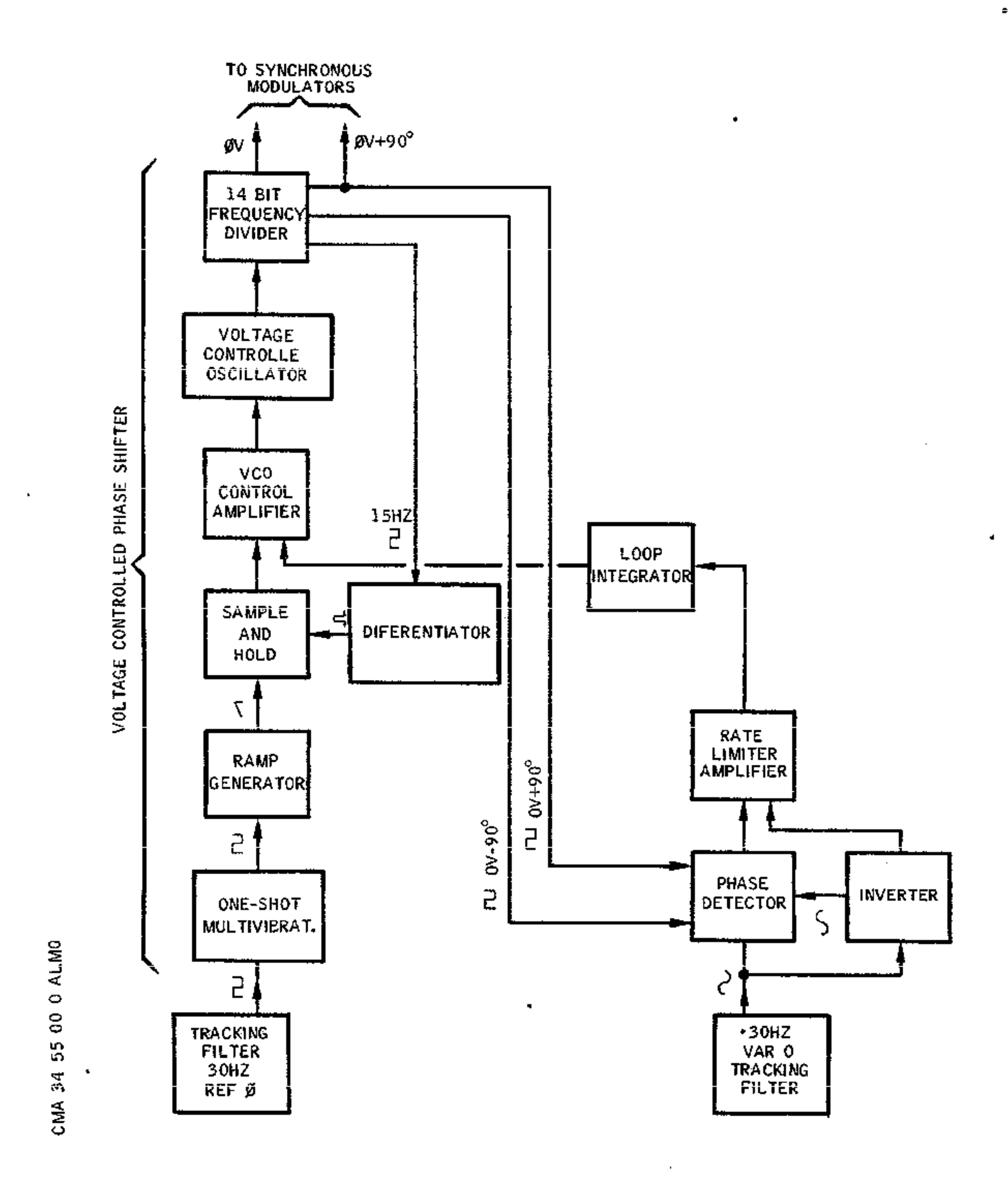


AUTOMATIC VOR - Block Diagram
Figure 004



TRACKING FILTER - Block Diagram
Figure 005

stages eliminate phase instabilities which are always present in the fixed passband filter. A tracking filter is a coupler circuit composed of a voltage controlled selective filter, a crossover detector, a quadrature chopper and a loop integrator which times the frequency of the VCSF allowing it to track the input frequency with negligible error. The 30 Hz reference phase output of the tracking filter is sent to the voltage controlled phase shifter while the 30 Hz variable phase signal is processed by the phase detector and inverter where it is phase-shifted by 180°.
These stages form part of the phase lock loop. The function of the loop is to shift the phase of the 30 Hz variable phase signal so that one of the 30 Hz square wave outputs of the voltage controlled phase shifter is in phase with the 30 Hz reference phase and the other is shifted by 90° with reference to the 30 Hz reference. When the phase is locked, the square wave shifted by 90° and the 30 Hz simusoidal reference signal are in phase quadrature.
In these conditions, an alternating signal with no DC component is present at the output of the phase



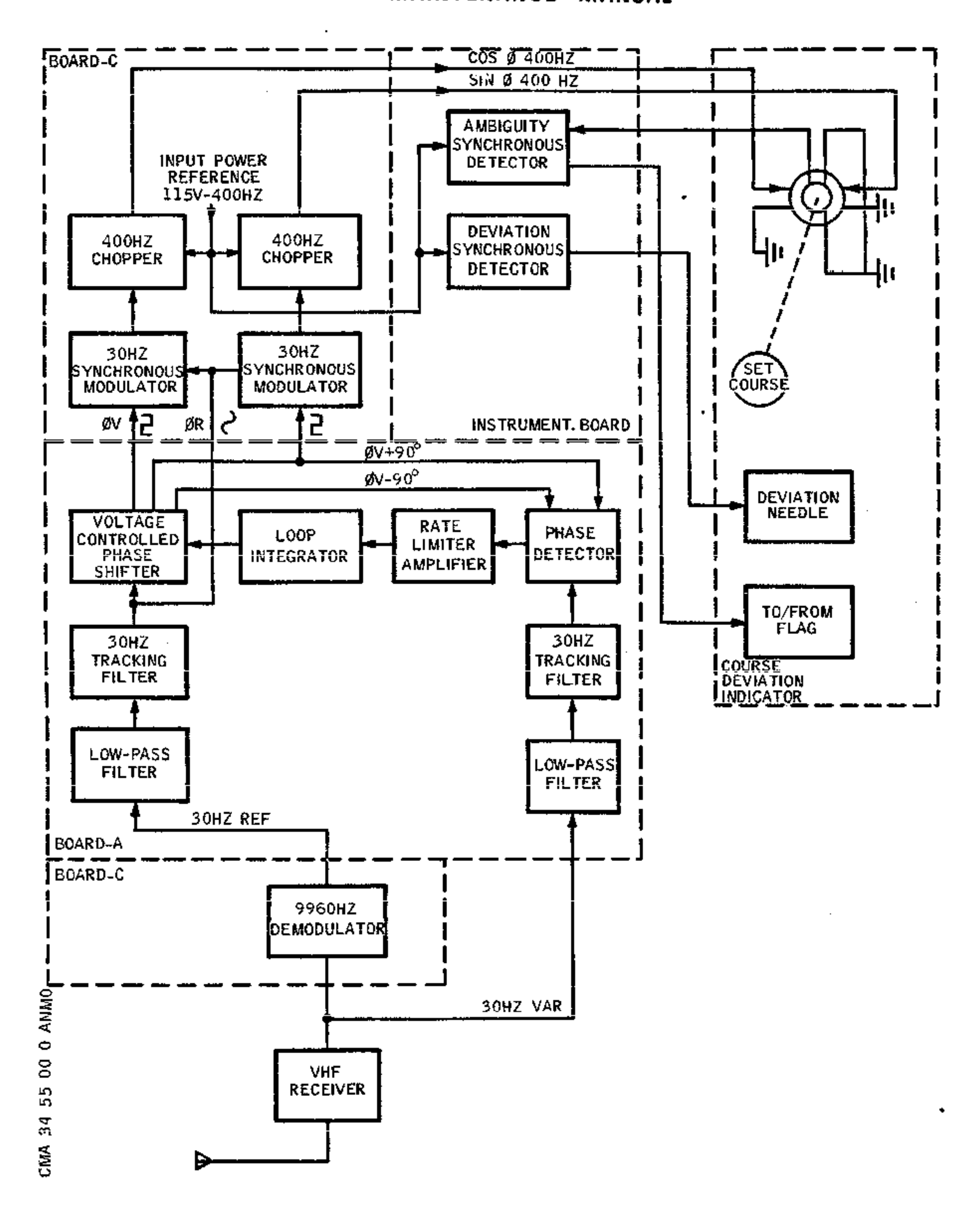
PHASE LOCK LOOP - Block Diagram
Figure 006

detector. In other conditions a DC voltage, with a value and polarity which is a function of the phase difference between the 30 Hz square wave and the 30 Hz simusoidal reference signal when they are not in quadrature appears at the phase detector output. This output controls a voltage controlled limiter which in turn controls the rate of change of phase of the 30 Hz variable phase signal. The output is amplified in the loop integrator and is fed to the voltage controlled phase shifter. This shifts the phase of the 30 Hz variable phase signal to maintain phase-locking, putting it into quadrature with the 30 Hz reference.
Module A outputs, 30 Hz and 30 Hz + 90° reference phase containing VOR information are sent to two synchronous modulators in which they are compared. The value and polarity of the DC levels of the synchronous modulators represent the sine and cosine of the phase difference angles between the 30 Hz reference phase and variable phase signals. Two 400 Hz choppers convert the DC levels to 400 Hz sine θ and cosine θ form of the station bearing. These voltages are applied through driver amplifiers to RMI remote display differential transolvers.

(3) Manual VOR Operation (Ref. Fig. 007)

In manual VOR operation, the reference phase and variable phase signals are processed in a similar manner as in automatic VOR operation up to the chopper outputs. Manual VOR is a term defining the use of a VOR radial selected by COURSE SET on the AP control unit to guide the aircraft. The resolver rotor is mechanically coupled to the COURSE SET selector knob. The rotor windings retransmit two 400 Hz signals to two synchronous detectors - ambiguity and deviation - these signals are a function of the position of COURSE SET and the bearing of the station. The detectors compare the rotor 400 Hz signal with the 400 Hz reference signal to provide deviation information to the angular deviation pointers on the HSI and ambiguity information to TO/FROM indicators on the HSI.

If the radial selected by COURSE SET corresponds to a bearing TO the station, the input supplied by the signal processing circuitry and the output voltage of the resolver rotor will be zero, and pointer deviation will be zero.
If the selected radial does not correspond to the bearing determined by the receiver, the pointer deviates either to right or left of the desired heading. The pilot must then turn the aircraft in the



Manual VOR Operation : Block Diagram
Figure 007

direction of pointer deviation in order to reach the selected radial.

(4) VOR Test (Ref. Fig. 008)

When VOR TEST switch on the control panel is depressed, TEST ENABLE switch is turned on, this enables TEST MODULATION GENERATOR, which provides a navigation signal equivalent to a bearing of 180°. This signal modulates the self-test oscillator whose output provides an RF signal to the receiver.
The warning sequence, reading of the 180° bearing on the RMI, centering of the vertical pointers on the HSI, reading TO on the ambiguity indicator verify correct system operation. Approximately two seconds after activation of the switch, instrument and AFCS flags must have disappeared ; approximately seven seconds later, the flags must reappear. With COURSE SET knob on the control unit positioned at 170°, HSI pointer deviation is approximately full scale to the right. In the 190° position, deviation is approximately full scale to the left. With COURSE SET in the 0° position, ambiguity indicator indicates FROM. Release VOR TEST switch. If the results are as described above the system is operational.

NOTE : During the test the antenna circuit is disconnected to cut off the antenna signal.

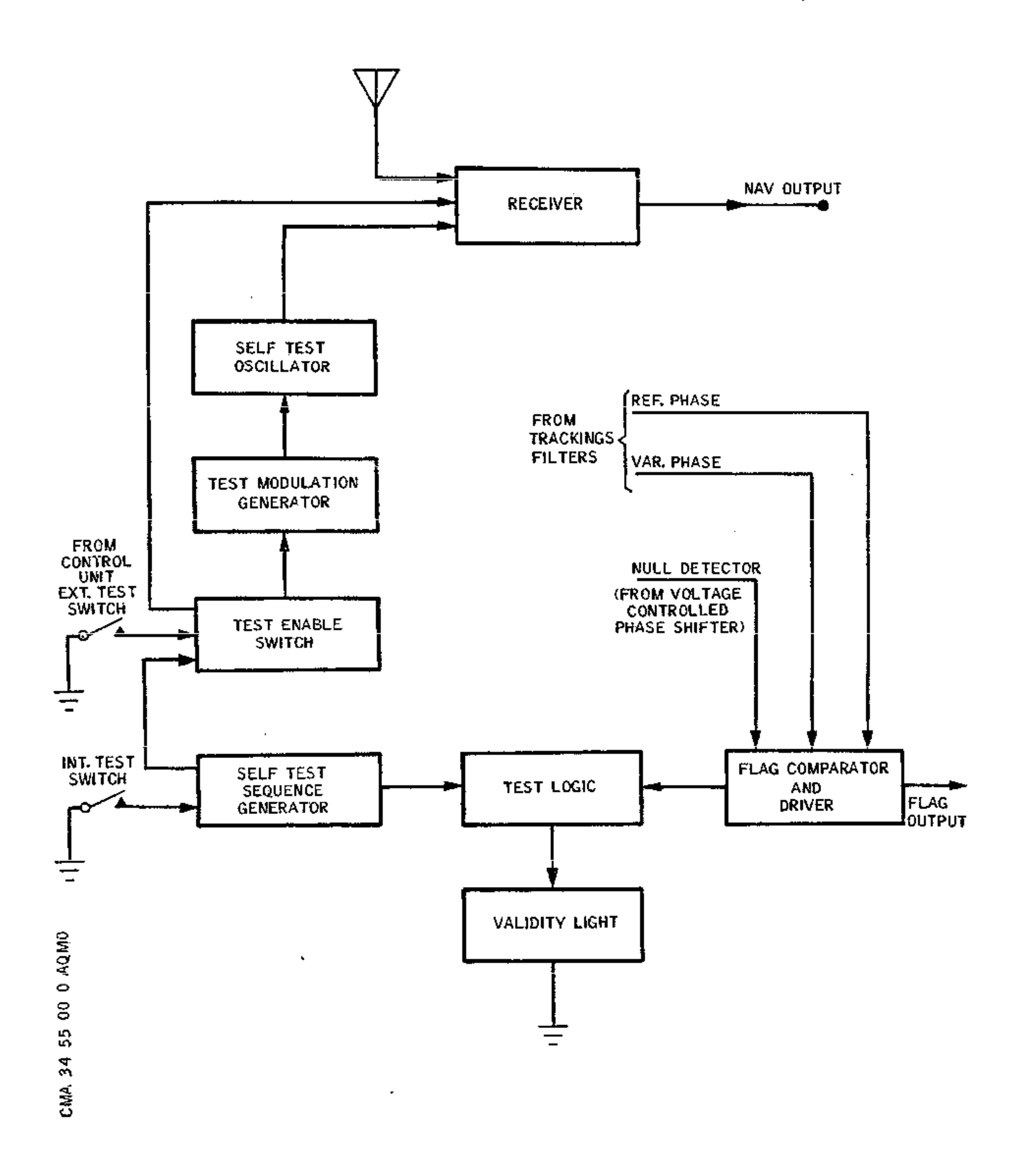
(a) SELF-TEST

The Self-test switch on the front panel is used by maintenance personnel. When the operator depresses TEST switch the SELF TEST SEQUENCE GENERATOR is activated. Its output enables ENABLE SWITCH for a fixed time and the VOR TEST SEQUENCE is activated as described above.

In addition the test logic turns on the validity light on the front panel. If the proper warning sequence occurs within the allotted time the lamp is extinguished. If the sequence does not occur the lamp remains illuminated indicating that the receiver is inoperative.

(5) Warning and monitor function

The warning and monitor functions of the receiver enable warning voltages when the following faults occur :



- VOR Receiver - Test and Self-Test System Block Diagram
Figure 008

- signal fault on the selected channel, or failure to conform with VOR standard
- out of tolerance error in phase lock loop
- AGC circuit monitoring, signal tracer 40 Hz is at incorrect level
- disappearance of signal tracer 14 KHz of the integrity monitor which monitor the input signals, VHF receiver module and the reference and variable phase signal processing modules
- percentage modulation of RF signal incorrect
- digital circuitry monitoring incorrect
- during VOR TEST, approximately two seconds after enabling the test, instrument and AFCS flags must disappear, approximately seven seconds later the flags must reappear. When all conditions for correct operation are fulfilled, a square wave signal at the instrument warning output holds the flags out of view.

(6) Angular reversion flag gate

This circuit generates a logic output used for angular deviation control on the HSI when the receiver is operating in this deviation mode. This information is distributed directly to the HSI indicators by selector switches 1F24 and 2F24.

(7) Power supply

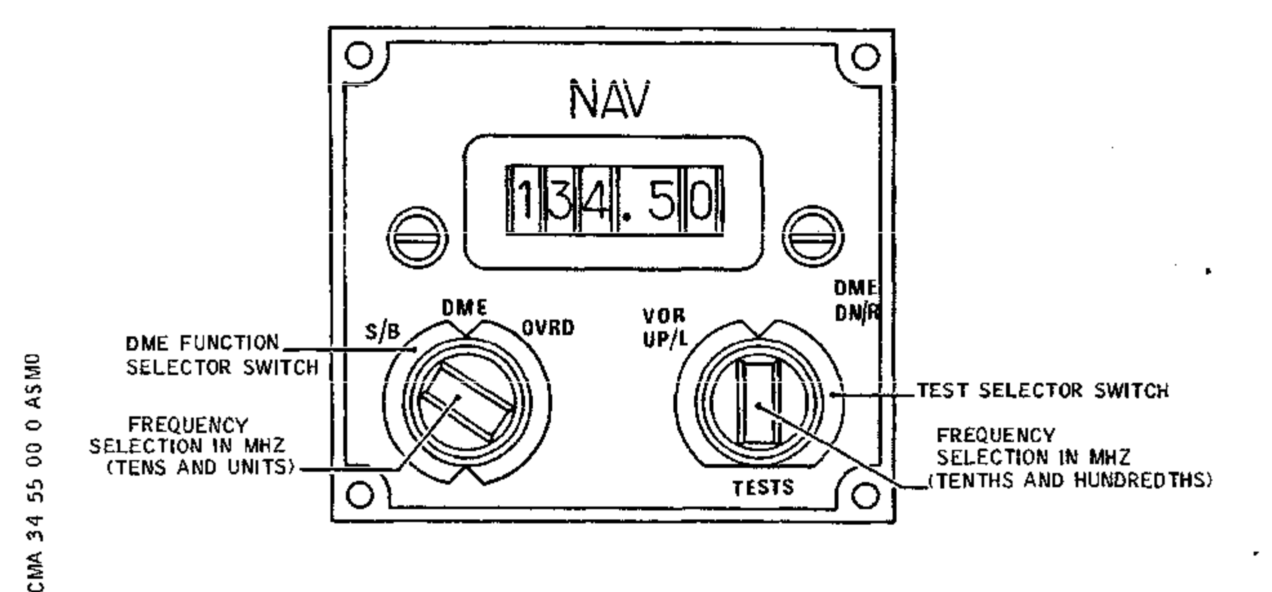
The 115 V, 400 Hz power applied to the power transformer is full wave rectified and stabilized by 3 regulators.

Output voltages- +16V, -16V, +5V regulated.

R 4. Control Unit BN 671D PN 50021 00 006
(Ref. Fig. 009)

A. Description

R The control unit is of rectangular form. On the front panel are : in the lower left corner, two concentric selector switches, the external 3 position switch S/B-DME-OVRD (Standby-DME-Override) enables remote control of the DME system. The center selector enables frequency selection in tens and units of MHz. At the lower right, three way TEST selector switch enables VOR, ILS or DME TEST. (The switch automatically returns to neutral position). The center selector enables frequency selection of tenths and hundredths of MHz. In the center of the front panel a window displays selected frequencies. White internal and window



VOR/ILS/DME Control Unit Front Panel
R Figure 009

illumination is provided.

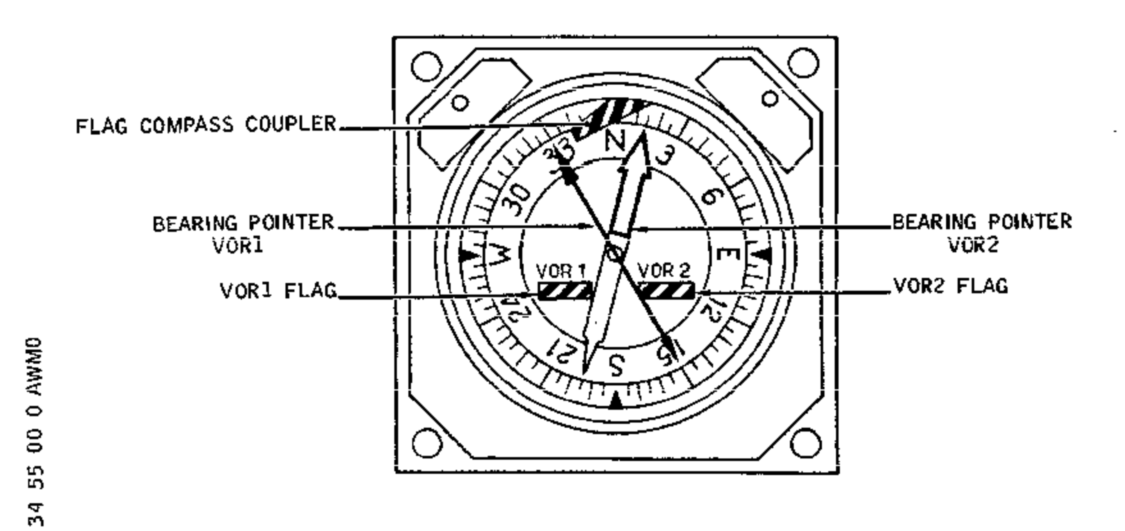
System interconnection is made via a connector on the rear panel.

B. Operation

Remote control of VOR-ILS-DME systems is achieved by the TWO OUT OF FIVE BINARY CODE method (40 ILS channels) in the 108 to 111.95 MHz band. The DME frequency is determined by the choice of VOR channel. Control is effected by resistance bridge. (TEST function is inhibited in DME mode when automatic pilot is engaged).

The VOR has 160 available channels at 50 KHz spacing in the 108 - 117.95 MHz band. The coaxial relay VOR-ILS antenna switch is energized by switching of an internal wafer switch. VOR frequency selection is made on odd channels.

5. Indicator - Radio Magnetic RMI/VOR - EAS Type IVA552 (Ref. Fig. 010)



CMA 34 55 00 0 AWM0

RMI/VOR Indicator : Front View
Figure 010

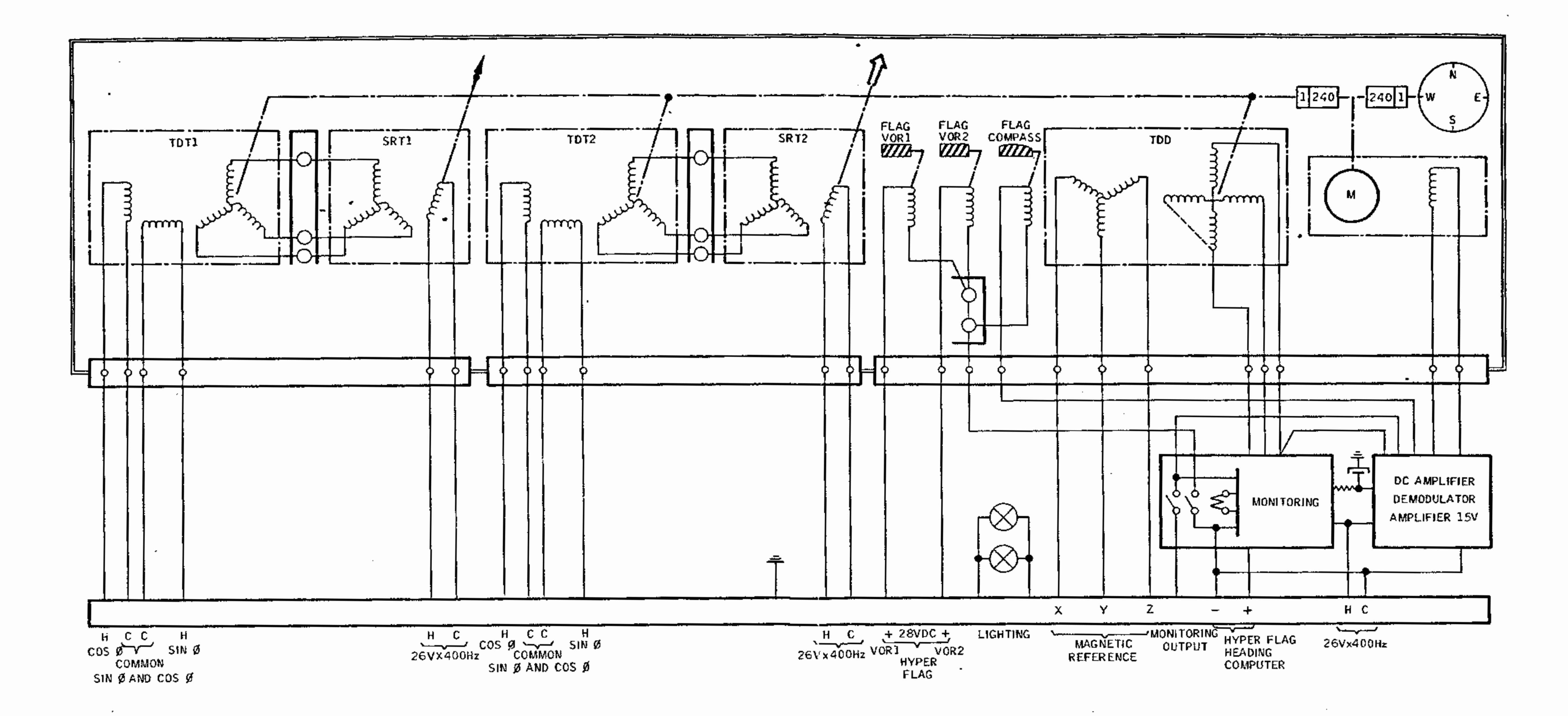
A. Description

The indicator is contained in a sealed metal case, in a neutral atmosphere of nitrogen and helium. The case and front panel are of grey colour, the unit is provided with white integral lighting. The bulbs are accessible from the front. Magnetic heading information is read on a printed compass card, graduated in 5° increments, coloured matt black, which moves before a lubber line on the upper part of the indicator. The card has numerical markings at 30° intervals and N.E.S. and W. indications in white. Bearings are indicated by two white-tipped pointers moving before the compass card. The double pointer corresponds to VOR 2 bearings, the single pointer corresponds to VOR 1 bearings. Aircraft system interconnection is made by a connector at the rear of the case.

B. Operation (Ref. Fig. 011)

The indicator has three functions. It indicates :

- magnetic heading - information from the compass coupler



CMA 34 55 00 0 AYMO

RMI/VOR Indicator - Block Diagram
Figure 011

- bearings 1 and 2 - information from VOR 1 and VOR 2 receivers
- warnings : 1 compass coupler flag
  2 VOR flags.

The servo-mechanisms in the unit present on the face information which comes from the systems in the form of electrical control signals, the indicator also includes a power supply, demodulator, amplifier and monitoring circuit.

Compass coupler information, magnetic NORTH reference control, is applied to differential detector transolver (TDD). The error voltage thus introduced is sent to the demodulator, powered by 26 V, 400 Hz. The error voltage, after demodulation, is sent as a DC voltage proportional to the AC voltage signal produced by the transolver, to the DC amplifier which supplies the motor which positions the compass card through a drive mechanism, thus indicating aircraft magnetic heading. The motor supply is 15 VDC regulated from the power supply.

VOR 1 and VOR 2 control information is sent to the remote indication differential transolver (TDT). The sine θ and cosine θ stators are energized by the signal supplied by the VOR receiver instrument stage. The remote display synchro-receivers (SRT) sense the induced voltages. The rotor, supplied by 26 V, 400 Hz power, repeats the angular position. The pointer coupled to the rotor enables reading of the VOR bearing.

C. Technical Characteristics

Compass card : ± 0.5°
Servo threshold : 0.2°
Servo-control rate : greater than 30°/second
Bearing precision : Better than 1° with reference to information transmitted by VOR receiver

D. Monitoring Circuit

The indicator monitors four parameters. The monitor stage, supplied by 15 Volts, regulated power, is activated in the following conditions :

- an error greater than two degrees
- an error originating in differential detector transolver
- error due to undervoltage (indicator operates normally between 20 and 26 Volts, 400 Hz)
- error due to a voltage drop in the 28 VDC network.

E. Warning Flags

An unbalance detected in one of the monitoring circuits causes appearance of the compass flag.
The flag appears on the upper part of the indicator face, masking the compass card lubber line.

In normal operation the VOR receiver supplies a voltage which holds the flags out of view. They appear when the indicator warning voltages are produced (Ref. (4) monitoring circuit) or when a voltage supplied by the VOR receiver is below the predetermined threshold.

F. Reading

Aircraft heading - magnetic NORTH reference - is read on the compass card before the lubber line on the indicator. The pointer corresponding to each receiver indicates the direction of the VOR station. The bearing indicated is relative to aircraft magnetic heading.

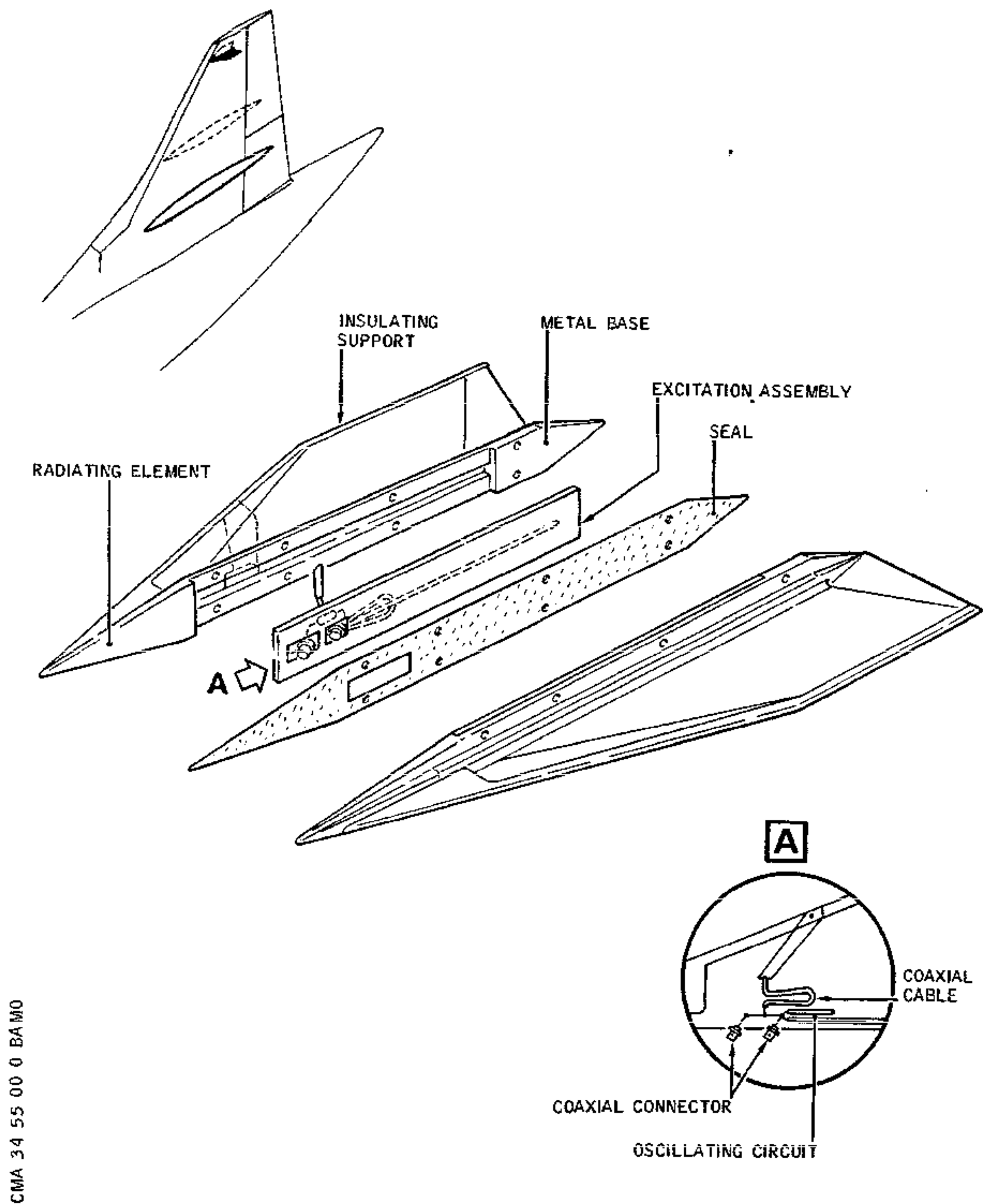
6. Antenna - VOR/LOC ACV0102
(Ref. Fig.012 and 013)
B - VOR/LOC SHELTON 19-182 (Ref. CM42036)

A. Description

The VOR/LOC antenna is used in both radio navigation and LOCALIZER modes. Installation of two hybrid couplers brings a net improvement in reduction of deviation between the two LOC information outputs.

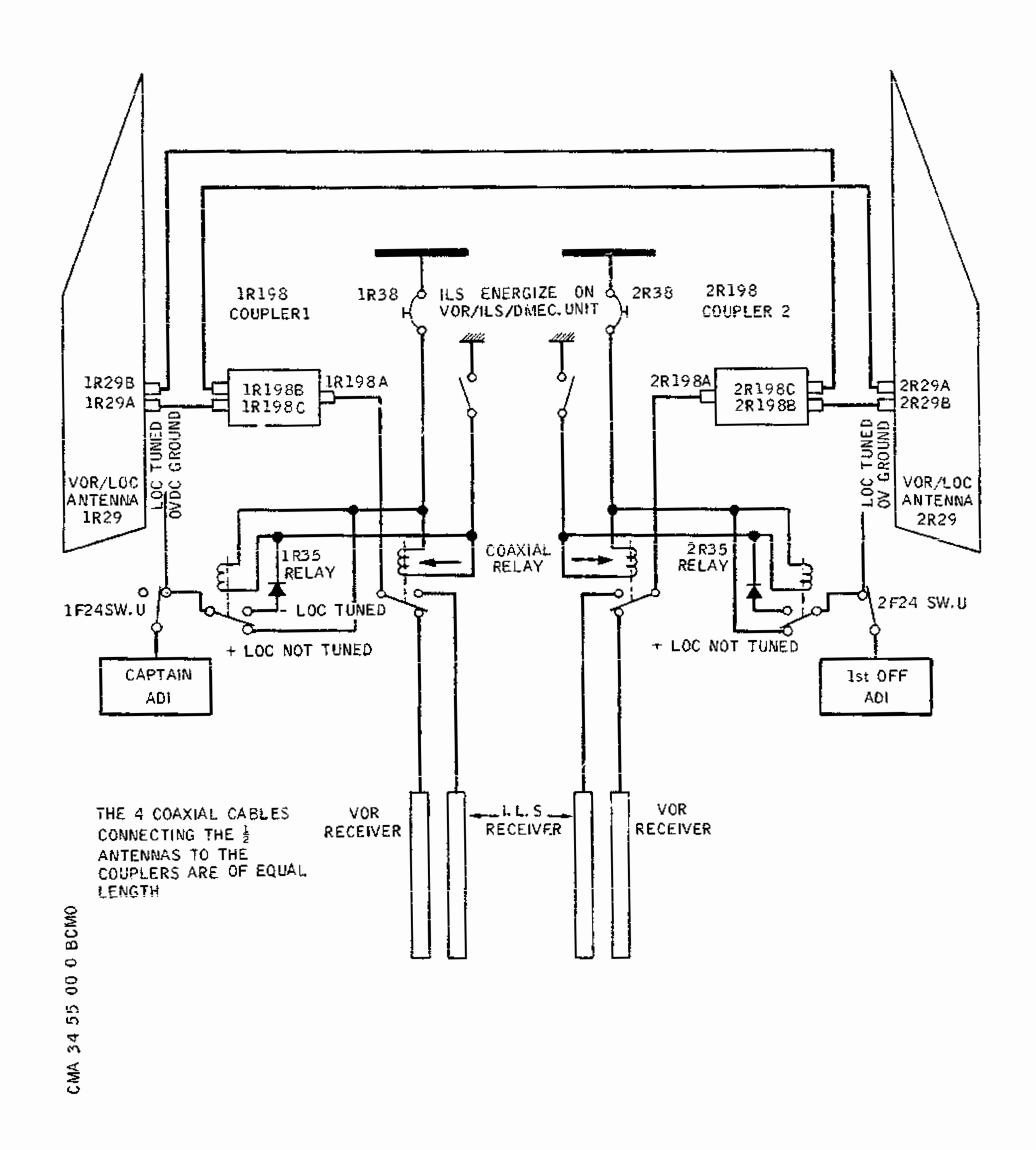
From the couplers, switching to the receivers of VOR or LOC is made by means of a coaxial relay operated by the system control panel. With the relay in the rest position the antenna is switched to the VOR receiver. The VOR antenna is externally mounted and streamlined, made up of two identifical half-antennas (ACV0102) mounted horizontally at each side of the fin, near the top. A 1/2 antenna consists of 4 sections :

- a metal base
- an insulated support of high temperature glass reinforced plastic
- the antenna radiating element consisting of the metal edge on the insulating support
- an excitation assembly which links the antenna with the coaxial cable through a matching circuit.
  The matching circuit is in the form of a plate on which are soldered :
  - a coaxial stub
  - a parallel oscillating circuit constructed of coaxial elements.



R

VOR-LOC Antenna - Exploded Diagram
Figure 012



VOR-LOC Antenna - Connections
Figure 013

R

- two parallel output coaxial connectors

From each half antenna, two coaxial cables of similar length, approximately 20 cm, each feed a hybrid coupler. Mounted near the antennas, coupler No.2 is installed on a bracket on the fin, coupler No.1 on an access panel at the right of the fin. The couplers are accessible without disturbing the antenna.

B. Operation

The antenna is normally used to feed 2 receivers. It operates in the 108 - 118 MHz band, horizontally polarized. The antenna signals are fed to the receivers in phase opposition, thus enabling almost omnidirectional coverage to be obtained in the horizontal plane. Impedance of each half antenna is 25 ohms, SWR, maximum 5.

7. System Operation

Start-up of the VOR system is made from the control unit, after setting of the appropriate circuit breakers. After the desired VOR station is found by selection of its working frequency, it is identified by its call sign received on the aural channel.

The receiver processes the received VOR signals and supplies in VOR automatic operation :

- analog information of omnidirectional bearings which is sent to the two RMI to give a continuous indication of VOR station bearing
- bearing information for use by the area navigation system.

In manual VOR operation :

- the pilot has available on the AFCS control unit a COURSE SET knob and a display window for the selected VOR radial. This radial will be followed in automatic flight (VOR cruise mode). Course deviations. With respect to this radial can be read on the HSI, indicated by the angular deviation bar
- according to COURSE SET selection, a TO/FROM indicator shows if the aircraft is flying towards the VOR station (TO indication visible) or away from the station (FROM indication visible). These indications are determined by the aircraft position on the VOR radial selected by the pilot
- deviation information is produced for the AFCS (Automatic Flight Control System)
- warning information is produced by the receiver in case of invalid signals or during self-test operation.

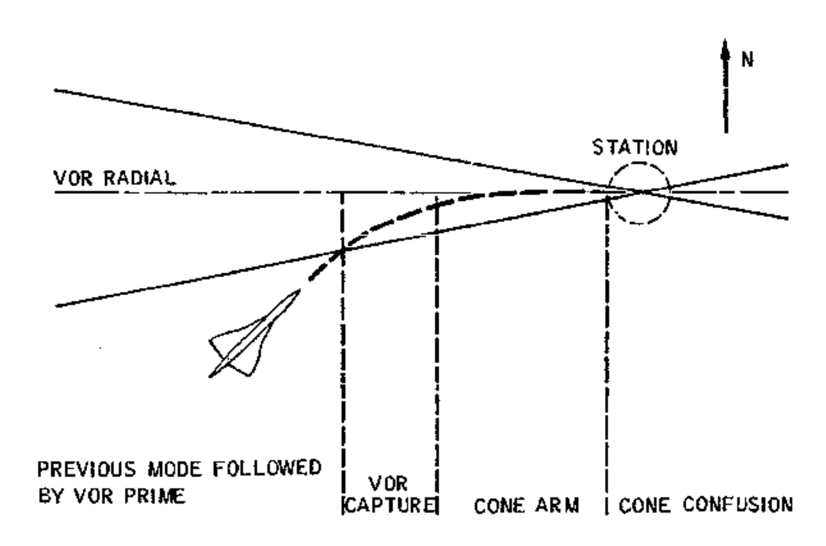
A. AFCS (Automatic Flight Control System)

(1) General

One of the functions of the automatic flight control system is to maintain in cruise mode a selected course on the AFCS control unit. In cruise mode, a type of radio guidance used by the lateral computers in the Automatic Pilot/Flight Director, is VOR. The guidance is effected from station to station by selection of frequency and of magnetic heading of the VOR station to be reached.

The aircraft follows the radial of the desired station, thus in effect using the omnidirectional beam as an apparently directional beam.

(2) VOR mode (Ref. Fig. 014)



CMA 34 55 00 0 BEMO

Automatic Flight : VOR Mode Sequences
Figure 014

After VOR station frequency selection, and selection of radial by means of COURSE SET knob on the AFCS control unit (reading is made in the window below the control knob), mode acquisition is made in 4 sequences.

R (a) First phase VOR PRIME.

R The computer remains in the previous mode until
R intersection and capture of the VOR beam (an
R indicator light indicates to the pilot that the
R mode is selected but not engaged).

R (b) Second phase VOR CAPTURE.

R When the VOR beam is intersected, VOR mode engages
R automatically, the aircraft aligns itself on the
R station radial. Upon alignment, CONE ARM mode
R automatically engages and the computer receives
R integration information which enables improved
R holding of the beam.

R (c) Third phase CONE ARM.

R During this phase the computer receives infor-
R mation from the VOR receiver - it takes into
R account the radial error introduced by VOR/LOC
R Beam Error module.

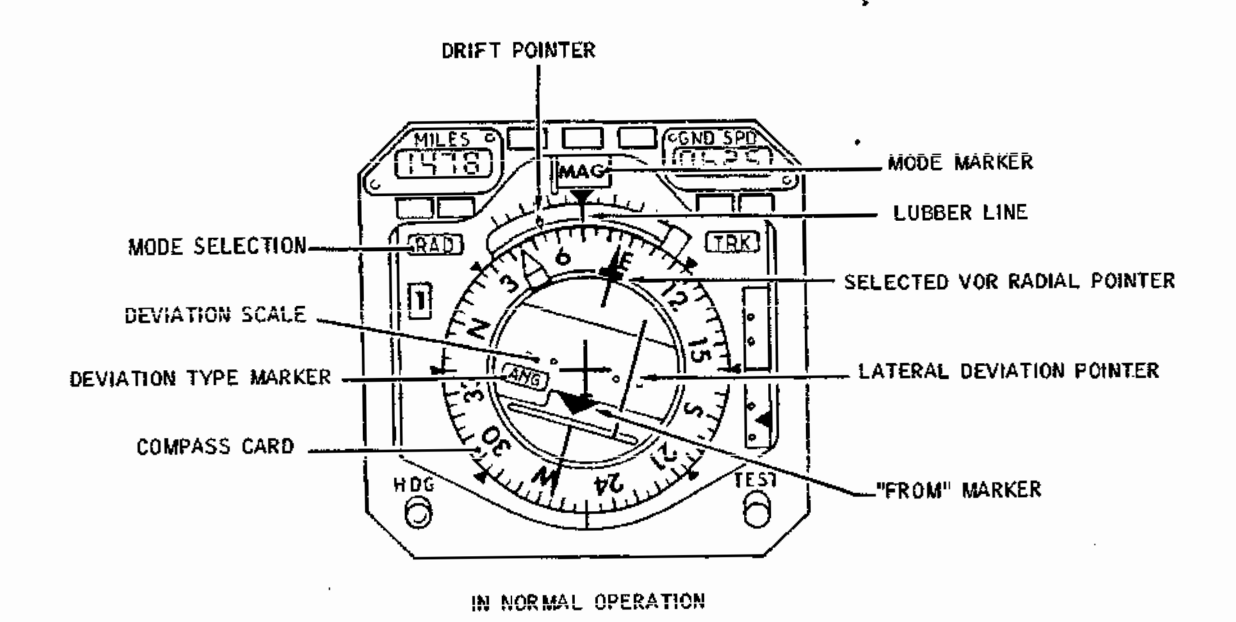
R (d) Fourth phase CONE

R When the aircraft enters the cone of confusion -
R above the ground station - information from
R Course Set Error module enables the correct course
R to be maintained, even though the VOR receiver
R signals are effectively inhibited, thus eliminat-
R ing errors due to radial signal imprecision in
R this zone. Angle of bank limit during capture and
R normal control is ± 30°. During CONE phase, the
R beam error signal is disconnected to allow a
R possible change of radial.

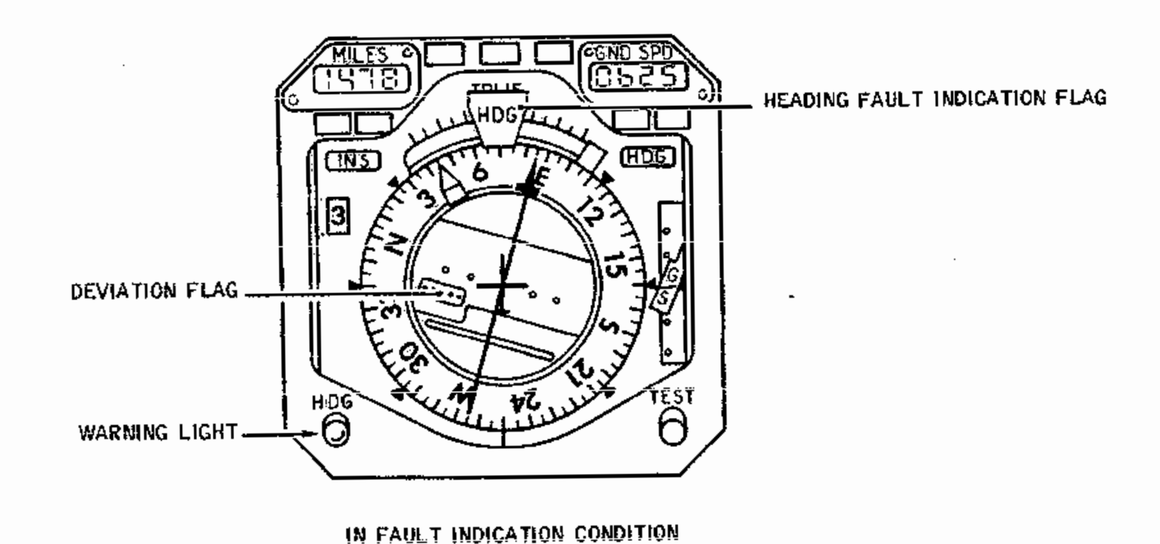
R B. HSI - Horizontal Situation Indicator (Ref. Fig. 015)

R (1) General

R On the indicator, the selected VOR radial is indicated
R on the compass card by a pointer. In RADIO (MAG) mode
R the pointer is controlled by the position of the VOR
R radial selection knob. Lateral deviation angle with
R respect to the selected VOR radial is indicated by
R the lateral deviation pointer which moves over a
R deviation scale. The mask on which the deviation
R indicator elements are mounted is mechanically linked
R to the reference course pointer so that the lateral
R deviation pointer is in the same direction as the refe-
R rence course pointer. The lateral deviation pointer



IN NORMAL OPERATION



IN FAULT INDICATION CONDITION

CMA 34 55 00 0 BGM0

R

HSI - Front View
Figure 015

represents the reference course with respect to the aircraft symbol in the center of the dial. RAD information is visible in the mode selection window.

(2) LIN-ANG-FLAG DEVIATION marker

A 3-position marker, -LIN-ANG-FLAG DEVIATION at the left of the face shows the VOR flag, if necessary, in radio mode (flag is marked with white points resembling the deviation scale). When the VOR receiver indicates an angular lateral deviation, the marker shows ANG. The 2 extreme end points of the scale correspond to ± 10°.

(3) TO-FROM marker

A white arrow pointing in the same direction as the course pointer provides TO indication. It disappears and a second arrow appears in the opposite sense to give a FROM indication. The galvanometer which carries the two arrows is also mounted on the mask carrying the deviation indicator elements.

(4) Warnings

In case of VOR fault, the flag NAV is visible and the bar centers.

8. Switching of VOR information to the indicators

On Captain instrument panel 2-211, switch (1R26) DEV1/DEV2 enables switching of either VOR1-ILS1/ILS2 or VOR2-ILS2/ILS1 system information to the Captain HSI and ADI.
The normal position is with switch Captain (1R26) in DEV1 position, First Officer switch (2R26) in DEV2 position.
On First Officer instrument panel 2-212, switch 2R26 DEV2/DEV1 enables switching of either VOR2-ILS2/ILS1 or VOR1-ILS/ILS2 system information.
The switches control selector switches 1F24 and 2F24, VOR1-ILS1/ILS2-VOR2-ILS2/ILS1 respectively.
The wiring of switches 1R26 and 2R26 inhibits crossing of information between Captain and First Officer instrument panels (when selection has been made on one switch, operation of the other switch has no effect).
TO/FROM information sent by the VOR receivers, cut off by the corresponding relay 1 or 2R35 in the rest position is then sent to the selector switches 1 and 2F24. According to the ILS ENERGIZE switching on NAV control boxes corresponding relays 1 or 2R35 are energized causing cut off of distribution of TO/FROM information to the HSI indicators.

R LOC NOT TUNED (+ 28VDC), ILS receiver not in operation, and LOC TUNED (OV GROUND), ILS frequency selected signals are distributed by contacts A3 and A1 respectively of relays 1 and 2R35, energized from the VOR/ILS/DME control unit.
R The information is passed through the switching units. LOC NOT TUNED enables the pointers and ILS warning flags to be held out of view in VOR mode.

VHF OMNIRANGE - TROUBLE SHOOTING

WARNING : OBSERVE THE SAFETY PRECAUTIONS DESCRIBED IN 34-00-00, SERVICING.

1. General

The following trouble shooting procedures are intended to enable faults found in flight or on the ground to be quickly rectified. The defect can be isolated with the aid of the trouble shooting procedures and traced through OK and NOT OK paths to the appropriate charts or other specified rectification action as may be necessary.
If a defect occurs perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure the operation is OK.
Bracketed numbers in the procedures and charts indicate items on the component identification Table (Ref. table 101).
The table provides information, including component location, required for rectification.
All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).
The 2 systems are similar and trouble shooting procedure is described for system 1. For system 2 trouble shooting, follow identical procedure, replacing the system number by the number in parentheses.

2. Prepare

A. Switching. State of systems before start-up (Ref. 34-55-00-5A).

3. Trouble Shooting

```
*****************************************************
* With ground test unit in operation, select its    *
* frequency on VOR/ILS/DME No.1 (No.2) control unit. *
* On Captain (First Officer) HSI, RAD, MAG and 1 (2) *
* markers are visible. GLIDE pointer and GS flag are *
* not visible. NAV flag is in view. On the RMI VOR   *
* indicators heading dials read aircraft heading,    *
* VOR1 (VOR2) flags are visible.                     *
*****************************************************
    || |
    || |         -----------------------------------------------
    || |         | RAD and MAG markers not visible on HSI.     |
    || |-NOT OK--| Ref. Chart 101.                             |
    || |         -----------------------------------------------
    || |
    || |         -----------------------------------------------
    || |         | 1 (2) marker is not visible on HSI          |
    || |-NOT OK--| Ref. Chart 102.                             |
    ||           -----------------------------------------------
    OK
```

Center lateral deviation bar on HSI by means of VOR-LOC-REF knob on AP1 (2) control box. On VOR/ILS/DME No.1 (No.2) hold TESTS selector switch in VOR position, check test sequences on instruments :

Sequences	On HSI	On RMI/VOR
After 7 seconds	NAV flag disappears TO/FROM arrow reverses. Deviation bar deviates 1 point to right	VOR flag disappears single pointer indicates 180° on dial
After 12 seconds	TO/FROM arrow returns to its initial position. NAV flag returns to view	Single needle indicates 180°. VOR flag returns to view.

Release test selector switch. Initial indications reappear on indicators. IF

```
    || |
    || |
```

```
  ||   |
  ||   |-NOT OK--| No self test operation. Ref. Chart 103.      |
  ||   |
  ||   |         | Flag does not disappear on RMI/VOR           |
  ||   |-NOT OK--| Ref. Chart 104.                              |
  ||   |
  ||   |-NOT OK--| Flag does not disappear on HSI. Ref. Chart 105.|
  ||   |
  ||   |         | Single pointer does not indicate 180° on an  |
  ||   |-NOT OK--| RMI/VOR. Ref. Chart 106.                     |
  ||   |
  ||   |         | Lateral deviation bar does not deviate on HSI. |
  ||   |-NOT OK--| Ref. Chart 107.                              |
  ||   |
  ||   |         | TO/FROM arrow does not reverse on an HSI.    |
  ||   |-NOT OK--| Ref. Chart 108.                              |
  ||
******************************************************
* Pnt ground test unit into operation, select 0°     *
* radial. On Captain (First Officer) HSI, NAV flag   *
* disappears. On Captain (First Officer) RMI/VOR     *
* VOR1 (VOR2) flag disappears. IF                    *
******************************************************
  ||   |
  ||   |         | Flags do not disappear on indicators.        |
  ||   |-NOT OK--| Ref. Chart 109.                              |
  ||
```

```
*****************************************************
* Lateral guidance operation check. Vary value of    *
* radial selected on ground test unit. Deviation bar *
* on HSI deviates. Cease variations and recentre     *
* deviation bar on HSI by means of VOR-LOC-REF knob  *
* on AP1 (2) control box. Read in AP control box     *
* window radial selected on ground test unit ± 180°. *
* On HSI reference track pointer indicates same      *
* value to 180 ± 5°, TO arrow appears for a value    *
* to ± 5°, FROM arrow for a value to 180 ± 5°. IF    *
*****************************************************
    ||   |
    ||   |         -------------------------------------------------
    ||   |         | HSI deviation bar does not indicate deviation |
    ||   |-NOT OK--| Ref. Chart 110.                               |
    ||             -------------------------------------------------
    ||
    ||             -------------------------------------------------
    ||             | TO/FROM indication is incorrect. Replace VOR  |
    ||             | receiver [5] ([6]).                           |
    ||             -------------------------------------------------
    OK
    ||
*****************************************************
* Check of identification signal. On Captain and     *
* First Officer jack panels make certain that a boom-*
* set is connected to BOOM SET connector. On Captain *
* and First Officer audio selector panel release     *
* VOR/ILS/DME1 (2) reception push-buttons, turn      *
* volume control knob to maximum. On ground test     *
* unit activate modulated signal. Check presence of  *
* audio signal successively at each station, check   *
* volume control knob operation on audio selector    *
* panel. IF                                          *
*****************************************************
    ||   |
    ||   |         -------------------------------------------------
    ||   |         | No reception of VOR signal                    |
    ||   |-NOT OK--| Ref. Chart 111.                               |
    ||             -------------------------------------------------
    ||
    ||
```

```
*************************************-------------------------------
* RAD-MAG MARKERS NOT VISIBLE ON HSI *| GROUND EQUIPMENT REQUIRED    |
**************************************|------------------------------|
                                      | DESCRIPTION         PART NO. |
                                      |------------------------------|
                                      | MULTIMETER                   |
                                      --------------------------------
--------------------------------------      --------------------
| Check circuit breaker [7] ([8])    |---NO---| Replace circuit  |
| 28VDC at output.                   |        | breaker [7] ([8])|
--------------------------------------      --------------------
                  |
                 YES
                  |
--------------------------------------
| Replace RAD/INS switching unit [9] |
| ([10]).                            |
--------------------------------------
                  |
                  NO
                  |
--------------------------------------
| Replace HSI indicator [3] ([4]).   |
--------------------------------------
                  |
                  NO
                  |
--------------------------------------
| Replace RAD/INS switch [11] ([12]).|
--------------------------------------
```

Chart 101

1 (2) MARKER NOT VISIBLE ON HSI

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
MULTIMETER	

RAD and MAG markers are visible : Check circuit breaker [13] ([14]) 28VDC at output

- NO → Replace circuit breaker [13] ([14])

YES ↓

Replace RAD/INS VOR/ILS1 - VOR/ILS2 switching unit [9] ([10]).

NO ↓

Replace HSI [3] ([4]).

NO ↓

Replace DEV1/DEV2 switch [15] ([16]).

Chart 102

```
**************************************-------------------------------
* NO SELF TEST OPERATION             *| GROUND EQUIPMENT REQUIRED   |
**************************************|-----------------------------|
                                      | DESCRIPTION        PART NO. |
-------------------------------------||-----------------------------|
| TEST light on VOR receiver front   || MULTIMETER                  |
| panel remains illuminated.         |-------------------------------
--------------------------------------
                 |                |      -------------------------
                NO                |--YES--| Replace VOR receiver  |
                 |                        | [5] ([6]).            |
--------------------------------------   -------------------------
| Carry out self test by means of    |   -------------------------
| push-button on VOR receiver front  |-YES-| Replace control unit  |
| panel.                             |     | [1] ([2]).            |
--------------------------------------   -------------------------
                 |
                NO
                 |
--------------------------------------   -------------------------
| Check circuit breaker [17] ([18])  |--NO-| Replace circuit       |
| 115 VAC 400 Hz at output.          |     | breaker [17] ([18]).  |
--------------------------------------   -------------------------
                 |
                YES
                 |
--------------------------------------
| Replace VOR receiver [5] ([6]).    |
--------------------------------------
```

Chart 103

```
*************************************-------------------------------
* FLAG DOES NOT DISAPPEAR ON RMI/VOR *| GROUND EQUIPMENT REQUIRED   |
*************************************|-----------------------------|
                                     | DESCRIPTION        PART NO. |
                                     |-----------------------------|
                                     | MULTIMETER                  |
                                     -------------------------------

-------------------------------------      --------------------------
| Flag disappears on second system  |-YES-| Replace faulty RMI/     |
| RMI/VOR.                          |     | VOR [19] ([20]).        |
-------------------------------------      --------------------------
                 |
                 NO
                 |
------------------------------------       --------------------------
| Flag is not visible on HSI       |--NO--| Replace VOR receiver    |
------------------------------------      | [5] ([6]).              |
                 |                         --------------------------
                YES
                 |
------------------------------------
| Check wiring Ref. WDM 34-55-02   |
------------------------------------
```

Chart 104

```
**************************************
* NAV FLAG DOES NOT DISAPPEAR ON HSI *
**************************************

-------------------------------------      ------------------------
| The flags are not visible on the  |--NO--| Replace VOR receiver |
| two RMI/VOR                       |      | [5] ([6]).           |
-------------------------------------      ------------------------
                  |
                 YES
                  |
-------------------------------------      ------------------------
| By means of DEV1/DEV2 switches,   |--NO--| Replace ILS receiver |
| supply inputs to the 2 HSI from the|     | [21] ([22]).         |
| same system. NAV flag disappears on|     ------------------------
| second HSI.                       |                 |
-------------------------------------                 |
                  |                                   |
                 YES                                  NO
                  |                                   |
-------------------------------------                 |
| Replace faulty HSI                |                 |
-------------------------------------                 |
                  |                                   |
                  NO                                  |
             ------------------------------------------------------
             | Replace RAD/INS and VOR/ILS1-VOR/ILS2 switching unit|
             | [9] ([10]).                                        |
             ------------------------------------------------------
```

Chart 105

```
************************************
* SINGLE (DOUBLE) POINTER DOES NOT   *
* INDICATE 180° ON ONE RMI/VOR       *
************************************

************************************
* SINGLE (DOUBLE) POINTER INDICATES  *
* 180° ON SECOND RMI/VOR             *
************************************
        |                     |
        NO                    YES
        |                     |
--------------------  --------------------
| Replace VOR recei-|  | Replace faulty    |
| ver [5] ([6]).    |  | RMI/VOR           |
--------------------  --------------------
```

Chart 106

```
*************************************
* LATERAL DEVIATION BAR ON HSI DOES *
* NOT DEVIATE                       *
*************************************

-------------------------------------          -----------------------
| By means of DEV1/DEV2 switches    |          | Replace VOR receiver |
| supply inputs to the two HSI from |--NO--| [5] ([6]).            |
| the same system. Lateral deviation |         -----------------------
| bar deviates on second HSI.       |                     |
-------------------------------------                     NO
                 |                                        |
                YES                            -----------------------
                 |                             | Replace ILS receiver |
-------------------------------------          | [21] ([22]).         |
| Replace faulty HSI.               |          -----------------------
-------------------------------------
                 |
                NO
                 |
-------------------------------------
| Replace RAD/INS and VOR/ILS1      |
| VOR/ILS2 [9] ([10]).              |
-------------------------------------
```

Chart 107

```
*************************************
* TO/FROM ARROW DOES NOT REVERSE ON *
* ONE HSI.                          *
*************************************

-------------------------------------          -----------------------
| By means of DEV1/DEV2 switches    |          | Replace VOR receiver |
| supply inputs to the two HSI from |--NO--| [5] ([6]).           |
| the same system. TO/FROM arrow    |          -----------------------
| reverses on second HSI.           |
-------------------------------------
                 |
                YES
                 |
-------------------------------------
| Replace faulty HSI                |
-------------------------------------
                 |
                 NO
                 |
-------------------------------------
| Replace RAD/INS and VOR/ILS1-     |
| VOR/ILS2 switching unit.          |
-------------------------------------
```

Chart 108

```
***********************************-------------------------------
* FLAGS DO NOT DISAPPEAR ON INDICAT- *| GROUND EQUIPMENT REQUIRED  |
* ORS.                              *|----------------------------|
***********************************| DESCRIPTION       PART NO. |
                                    |----------------------------|
------------------------------------| MULTIMETER                  |
| Replace VOR receiver [5] ([6])   ||----------------------------|
------------------------------------| VOR/ILS GROUND TEST UNIT    |
                 |                  -------------------------------
                 NO
                 |
------------------------------------
| Replace control unit [1] ([2]).  |
------------------------------------
                 |
                 NO
                 |
------------------------------------      -------------------------
| Check coaxial relay [23] ([24])  |--NO--| Replace coaxial relay|
------------------------------------      | [23] ([24])            |
                 |                        -------------------------
                YES
                 |
------------------------------------      -------------------------
| Check coupler [25] ([26])        |--NO--| Replace coupler [25]   |
------------------------------------      | ([26]).                |
                 |                        -------------------------
                 NO
                 |
------------------------------------
| Replace VOR/LOC antenna [27] ([28])|
------------------------------------
```

Chart 109

```
************************************
* LATERAL DEVIATION BAR ON HSI DOES  *
* NOT INDICATE DEVIATION.            *
************************************

------------------------------------
| Replace VOR receiver [5] ([6]).    |
------------------------------------
                 |
                YES
                 |
************************************
* WITH BAR CENTRED RADIAL DISPLAYED  *
* ON AP CONTROL BOX DOES NOT CORRES- *
* POND WITH RADIAL DISPLAYED ON      *
* GROUND TEST UNIT.                  *
************************************
                 |
                YES
                 |
------------------------------------
| Replace AFCS control unit [29].    |
------------------------------------
```

Chart 110

```
*************************************
* NO IDENTIFICATION SIGNAL AUDIBLE  *
*************************************

-------------------------------------     -----------------------
| At any crew station               |--YES-| Replace VOR receiver |
-------------------------------------      | [5] ([6]).           |
                 |                          -----------------------
                 NO                                   |
                 |                                   YES
-------------------------------------      -----------------------
| At a particular crew station      |      | Replace ILS receiver |
-------------------------------------      | [21] ([22]).         |
                 |                          -----------------------
                YES
                 |
-------------------------------------
| Replace faulty audio selector panel|
| Ref. 23-00-00 WDM 23-51-01         |
-------------------------------------
```

Chart 111

	ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
R	[1] VOR/ILS/DME control unit No.1		5-211	1R28	Flt. Cpt.	34-55-13 R/I	34-55-01
R	[2] VOR/ILS/DME control unit No.2		5-211	2R28	Flt. Cpt.	34-55-13 R/I	34-55-01
R	[3] Captain HSI		2-211	1F22	Flt. Cpt.	34-23-11 R/I	34-55-02
R	[4] 1st off HSI		2-212	2F22	Flt. Cpt.	34-23-11 R/I	34-55-02
R	[5] VOR receiver 1		215	1R24	7-215	34-55-31 R/I	34-55-01
R	[6] VOR receiver 2		216	2R24	5-216	34-55-31 R/I	34-55-01
	[7] RAD/INS 1ST PLT SW SUP		1-213	1F26	Map Ref. G 17	24-50-00 R/I	34-55-02
	[8] RAD/INS 2ND PLT SW SUP		15-216	2F26	Map Ref. E 21	24-50-00 R/I	34-55-02
R	[9] RAD/INS and VOR/ILS 1 - VOR/ILS 2 switching unit		215	1F24	7-215	34-23-13 R/I	34-55-02
R	[10] RAD/INS and VOR/ILS 1 - VOR/ILS 2 switching unit		216	2F24	5-216	34-23-13 R/I	34-55-02
R R	[11] RAD/INS switch		5-211	1F25	Flt. Cpt.	34-23-17 R/I	34-55-02
R R	[12] RAD/INS switch		5-211	2F25	Flt. Cpt.	34-23-17 R/I	34-55-02
	[13] DEV 1 & 2 1ST PLT SW SUP		1-213	1R38	Map Ref. G 14	24-50-00 R/I	34-55-02

	ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
	[14] DEV 1 & 2 2ND PLT SW SUP		15-216	2R38	Map Ref. F 21	24-50-00 R/I	34-55-02
R	[15] DEV 1/ DEV 2 switch		2-211	1R26	Flt. Cpt.	34-55-14 R/I	34-55-02
R	[16] DEV 1/ DEV 2 switch		2-212	2R26	Flt. Cpt.	34-55-14 R/I	34-55-02
R	[17] VOR VHF NAV 1 SUP		2-213	1R33	Map Ref. G 7	24-50-00 R/I	34-55-01
	[18] VOR VHF NAV 2 SUP		13-216	2R33	Map Ref. E 14	24-50-00 R/I	34-55-01
R	[19] RMI/VOR No.1		2-211	1R27	Flt. Cpt.	34-55-22 R/I	34-55-02
R	[20] RMI/VOR No.2		2-212	2R27	Flt. Cpt.	34-55-22 R/I	34-55-02
R	[21] ILS No.1 receiver		215	1R37	7-215	34-36-31 R/I	34-55-02
R	[22] ILS No.2 receiver		216	2R37	5-216	34-36-31 R/I	34-55-02
	[23] Coaxial relay		215	1R31	7-215	34-55-32	34-55-01
	[24] Coaxial relay		215	2R31	5-216	34-55-32	34-55-01
R	[25] Coupler No.1	323QR	323	1R198	Fin	34-55-11 I/C	34-55-01
R	[26] Coupler No.2	323QR	323	2R198	Fin	34-55-11 I/C	34-55-01
	[27] VOR/LOC antenna		323	2R29	Fin	34-55-11 R/I	34-55-01
	[28] VOR/LOC antenna		323	2R29	Fin	34-55-11 R/I	34-55-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF.	
					MAINT. TOPIC	WIRING DIAGRAM
R [29] AFCS control unit		211	C1	5-211	22-11-21 R/I	34-55-02

Component Identification
Table 101

R **ON A/C 006-007,

VHF OMNIRANGE - ADJUSTMENT/TEST

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Boom Set (From Test Set)	TE2037000

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

(3) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYST1 SW SUP		1F 134	F14
DEV1 & DEV2 1ST PLT SW SUP		1R 38	G14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
No.1 INPH SUP		R 89	K19
1ST PLT AUDIO SELECTOR SUP		R 241	L21
HSI TRUE 1ST PLT INS1 SUP & IND	2-213	1F 21	B 6
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RMI VHF NAV1 IND		1R 34	C 6
COMPASS COUPLER 1 SUP		1F 130	F 8
VOR VHF NAV1 SUP		1R 33	G 7
FLT CONT & NAV BUS		X 355	H 2
No.2 INPH SUP	3-213	R 90	H 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
2ND PLT AUDIO SELECTOR SUP		R 242	H 3
RMI VHF NAV2 IND	13-216	2R 34	A19
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
COMPASS COUPLER 2 NORMAL SUP		2F 130	D15
RH DASH INST LTS SUP		L 371	E 9
VOR VHF NAV2 SUP		2R 33	E14
NAV INST BUS		X 345	G 4
LH DASH INST LTS SUP	13-215	L 372	A12
CTR DASH & G/SHIELD INST LTS SUP	14-216	L 375	D10
COMPASS COUPLER SYST2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV1 & 2ND PLT SW SUP		2R 38	F21

(4) On 5-211 make certain that function selectors on VOR/ILS/DME 1 and 2 control panels are in STBY position.

- On AFCS control unit (C1) make certain that no mode is engaged.
  Place both RAD/INS switches in RAD position.

(5) Start up INS 1 and 2 systems (Ref. 34-45-00, Adjustment/Test).

(6) In zone 8-214, make certain that DG/MAG switches on compass controller are in MAG position.

(7) On Captain instrument panel 2-211 place switches

(1F7) ATT INS1/INS3 in INS1 position
(1F133) COMP1/COMP2 in COMP1 position
(1R26) DEV1/DEV2 in DEV1 position
(1F33) NAV INS1/INS2 in INS1 position

(8) On First Officer instrument panel 2-212 place switches

(2F7) ATT INS3/INS2 in INS2 position
(2F133) COMP1/COMP2 in COMP2 position
(2R26) DEV1/DEV2 in DEV2 position
(2F33) NAV INS1/INS2 in INS2 position.

(9) By means of GLARESHIELD LIGHTING INST selector switch (L402 on 4-211) check that control unit lighting varies Place selector switch in OFF position.

(10) Check that HSI, RMI/VOR and ADI lighting operates correctly. Successively adjust RH DASH INST (5-211) and LH DASH INST (5-212) selector ; check that lighting varies. Place slectors in OFF position.

(11) On Captain jack panel, connect, or make certain that a boomset is connected.
On Captain audio selector panel, engage VOR/ILS/DME1 and 2 reception push-button.

C. VOR Test

(1) VOR1 System

(a) On VOR/ILS/DME1 control panel, select a local VOR frequency.

- Check that VOR beacon audio signal is audible in headset.
- On Captain HSI, NAV flag disappears, ANG annunciator appears, RAD, MAG and 1 markers are visible, TO or FROM arrow appears. HDG flag disappears
- On Captain and First Officer RMI/VOR flag disappears, single pointer indicates direction of the station
- Heading dials on HSI and RMI indicate magnetic heading

(b) On 5-211, on AFCS control unit (C1) centre lateral deviation bar by means of VOR/LOC REF No.1 button.

- Single pointers on RMI indicators indicate direction of VOR station selected.

(c) Place and hold TEST selector on control panel in VOR position.

- On Captain HSI :
NAV flag appears, lateral deviation bar centres or remains centred. After approximately 7 se-

conds, NAV flag disappears, lateral deviation bar moves to stop, TO-FROM arrow reverses. After approximately 12 seconds TO-FROM arrow disappears, NAV flag reappears.
- On Captain and First Officer RMI/VOR :
  VOR1 flag appears then disappears after approximately 7 seconds, single pointer is positioned at 180°, after approximately 12 seconds VOR1 appears, single needle indicates 180°.

(d) Release TEST selector on VOR/ILS/DME1 control panel.
- Initial indications reappear on the indicators.

(2) VOR2 System

(a) On VOR/ILS/DME2 control panel select a local frequency.

- Check that VOR beacon audio signal is audible in headset,
- On First Officer HSI, NAV flag disappears, ANG annunciator appears, RAD, MAG and 2 markers are visible, TO or FROM arrow appears. HDG flag disappears.
- On Captain and First Officer RMI/VOR, VOR2 flag disappears, double pointer indicates direction of station.

(b) On AFCS control unit (C1), using VOR/LOC REF No.2 button, centre lateral deviation bar.

- Double pointers on RMI indicators indicate direction of VOR station selected.

(c) Place and hold TEST selector on VOR/ILS/DME2 control panel in VOR position.

- On First Officer HSI :
  NAV flag appears, lateral deviation bar remains centered.
  After approximately 7 seconds NAV flag disappears, lateral deviation bar moves to stop TO-FROM arrow reverses. After approximately 12 seconds TO-FROM arrow disappears, NAV flag reappears.
- On Captain and First Officer RMI/VOR
  VOR2 flag appears then disappears after approximately 7 seconds, double pointer is positioned at 180°. After approximately 12 seconds VOR2 flag appears, double pointer indicates 180°.

(d) Release TEST selector on VOR/ILS/DME2 control panel

- Initial indications reappear on indicators.

D. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) On Captain audio selector panel (R53), release VOR/ILS/DME push-buttons, return volume controls to minimum.

(3) Disconnect headset from Captain jack panel if appropriate.

(4) Place MSU selectors 1 and 2 in OFF position to shut down INS.

(5) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(6) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
VOR/ILS Ground Test Unit (Cossor or Equivalent)	
Boomset (From Test Unit)	TE2037000

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

(3) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYST1 SW SUP		1F 134	F14
DEV1 & DEV2 1ST PLT SW SUP		1R 38	G14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
No.1 INPH SUP		R 89	K19
1ST PLT AUDIO SELECTOR SUP		R 241	L21
HSI TRUE 1ST PLT INS1 SUP & IND	2-213	1F 21	B 6
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RMI VHF NAV1 IND		1R 34	C 6
COMPASS COUPLER 1 SUP		1F 130	F 8
VOR VHF NAV1 SUP		1R 33	G 7
FLT CONT & NAV BUS		X 355	H 2
No.2 INPH SUP	3-213	R 90	H 2
2ND PLT AUDIO SELECTOR SUP		R 242	H 3
RMI VHF NAV2 IND	13-216	2R 34	A19
HST MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 SUP & IND		2F 21	C15
COMPASS COUPLER 2 NORMAL SUP		2F 130	D15
RH DASH INST LTS SUP		L 371	E 9
VOR VHF NAV2 SUP		2R 33	E14
NAV INST BUS		X 345	G 4
LH DASH INST LTS SUP	13-215	L 372	A12
CTR DASH & G/SHIELD INST LTS SUP	14-216	L 375	D10
COMPASS COUPLER SYST2 SW	15-216	2F 134	A21

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SUP			
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV1 & 2ND PLT SW SUP		2R 38	F21

(4) On 5-211 make certain that function selectors on VOR/ILS/DME 1 and 2 control panels are in STBY position.

- On 5-211, place both RAD-INS switches in RAD position
- On 5-211, on AFCS control unit (C1), make certain that no mode is engaged.

(5) Start up INS 1 and 2 (Ref. 34-45-00, Adjustment/Test).

(6) In zone 8-214, make certain that DG/MAG switches on compass controller are in MAG position.

(7) On Captain instrument panel 2-211 place switches.

(1F7) ATT INS1/INS3 in INS1 position
(1F133) COMP1/COMP2 in COMP1 position
(1R26) DEV1/DEV2 in DEV1 position
(1F33) NAV INS1/INS2 in INS1 position.

(8) On First Officer instrument panel 2-212 place switches.

(2F7) ATT INS3/INS2 in INS2 position
(2F133) COMP1/COMP2 in COMP2 position
(1R26) DEV1/DEV2 in DEV2 position
(1F33) NAV INS1/INS2 in INS2 position.

(9) By means of GLARESHIELD LIGHTING INST LIGHTS selector (L402 on 4-211) check that control panel illumination varies. Place selector in OFF position.

(10) Check that HSI RMI/VOR and ADI lighting operates correctly. Successively adjust RH DASH INST (5-211) and LH DASH INST (5-212) selectors, check that lighting varies. Place selectors in OFF position.

(11) Switch on VOR/ILS ground test unit for operation.

C. Test

(1) VOR No.1

(a) On ground test unit place function selector in VOR position, incremental VOR in 0 position, VOR BEARING in 0 position.

(b) Select on VOR/ILS/DME1 control panel working frequency of ground test unit.

- On Captain HSI, HDG flag disappears, RAD, MAG and 1 markers are visible, NAV flag disappears.
- On Captain and First Officer RMI/VOR, COMPASS flag disappears.
- HSI and RMI heading dials indicate magnetic heading.
- VOR 1 flag disappears.

(c) On AFCS control unit (C1) by means of VOR/LOC REF No.1 button, centre lateral deviation bar on Captain HSI, read in corresponding window 0 ± 5 degrees or 180 ± 5 degrees.

- On Captain HSI, reference track pointer indicates same value, TO arrow appears for 0 ± 5 degrees, FROM arrow for 180 ± 5 degrees.
- On Captain and First Officer RMI/VOR, VOR1 flag disappears, single pointer is positioned at NORTH on heading dial.

(d) On AFCS control box No.1 (C1), turn VOR/LOC REF button in increase direction.

- Captain HSI lateral deviation bar deviates left.

(e) Turn VOR/LOC REF button in decrease direction.

- Captain HSI lateral deviation bar deviates right, recentre bar.

(f) On ground test unit, place BEARING selector in 135° position, then centre HSI deviation bar by means of VOR/LOC1 button on AFCS control unit (C1)

- Read in corresponding window 135 ± 5° or 315 ± 5°.
- On Captain HSI, reference track indicator indicates same value, TO arrow appears for 135 ± 5°, FROM arrow for 315 ± 5°.
- On Captain and First Officer RMI/VOR, VOR1 flag has disappeared, single pointer indicates 135 ± 7°.

(g) Place First Officer DEV1/DEV2 switch in DEV1 position. On VOR ground test unit, place BEARING selector in 270° position.

- On First Officer HSI indications are identical with those of Captain HSI
- By means of VOR/LOC1 on AFCS control unit (C1), centre HSI lateral deviation bars, then read in corresponding window 270 ± 5° or 90 ± 5°.
- On HSI indicators, reference track pointers indicate similar values, TO arrow appears for 270 ± 5°, FROM arrow appears for 90 ± 5°.
- On Captain and First Officer RMI, VOR1 flag has disappeared, single pointer indicates 270 ± 7°.

(h) Return VOR test unit selector to 0 position, recentre HSI lateral deviation bars by means of VOR/LOC1 button on AFCS control unit (C1), then read in corresponding window 0 ± 5° or 180 ± 5°.

- On HSI indicators, reference track pointers indicate similar values, TO arrow appears for 0 ± 5°, FROM arrow for 180 ± 5°
- On Captain and First Officer RMI/VOR, VOR1 flag has disappeared, single pointer indicates 0±7°.

(i) Place switch DEV1/DEV2 on First Officer instrument panel in DEV2 position.

- First Officer HSI indications disappear.

(2) VOR 2 System

(a) On VOR/ILS/DME2 control panel select working frequency of ground test unit

- On First Officer HSI, RAD, MAG and 2 markers are visible, NAV flag is retracted HDG flag is retracted.
- On Captain and First Officer RMI/VOR, COMPASS flag has disappeared, VOR2 flag disappears.
- HSI and RMI heading dials indicate magnetic heading.

(b) Repeat test in paragraph C (c) reading :

VOR/LOC REF2 button in place of 1, First Officer HSI in place of Captain, DEV1/DEV2 (1R26) in DEV2 position, on RMI indicators, double pointer in place of single pointer.

(3) Check of reception on the two receivers

(a) On Captain and First Officer jack panels (R57, R58) make certain of presence of a headset, or connect a headset to BOOMSET jack.

(b) On Captain and First Officer audio selector panels (R33, R54) release VOR/ILS/DME 1 and 2 reception selection push-buttons, turn volume control to maximum.

(c) On VOR ground test unit, place identification signal selector in ON position.

(d) Check presence of an audio signal on each headset successively, check adjustment of aural level by means of selector volume control button.

D. Close-Up

(1) Switch off ground test unit.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) On Captain and First Officer audio selector panels engage VOR/ILS/DME push-button, return volume control to minimum.

(4) Remove headsets from Captain and First Officer jack panels if appropriate.

(5) Place MSU 1 and 2 selectors in OFF position to shut down INS systems.

(6) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(7) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

3. System Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
VOR/ILS Ground Test Unit (Cossor or Equivalent)	
SWR Meter (Ferisol TO 201A or Equivalent)	
SWR Measurement Cable	
Boomset (From Ground Test Unit)	TE2037000

B. SWR Measurement

(1) Trip the following circuit breakers

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
VOR VHF NAV1 SUP	2-213	1R 33	G 7
VOR VHF NAV2 SUP	13-216	2R 33	E14

(2) Remove VOR1 receiver (1R24) from shelf 7-215.

(3) By means of SWR measurement cable, connect SWR meter to coaxial terminal A2 on connector 1R24AA.

(4) Measure and note SWR value for frequency of 115 MHZ. Its value must be maximum 5.

(5) Disconnect cable, install VOR1 receiver in its rack.

(6) Remove VOR2 receiver (2R24) from shelf 5-216.

(7) By means of SWR measurement cable, connect SWR meter to coaxial terminal A2 on connector 2R24AA.

(8) Measure and note SWR value for frequency of 115 MHZ. Its value must be maximum 5.

(9) Disconnect cable, install VOR2 receiver in its rack.

(10) Reset circuit breakers previously tripped in (1) above.

C. Test

For test procedure refer to Functional Test, paragraph 2.

D. Close-Up

(1) Refer to functional test para. 2D for close-up procedure.

1. Operational Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
Boom Set (from Ground Test Unit)	TE2037000

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Page 301, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

(3) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYST1 SW SUP		1F 134	F14
DEV1 & DEV2 1ST PLT SW SUP		1R 38	G14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
No.1 INPH SUP		R 89	K19
HSI TRUE 1ST PLT INS1 SUP & IND	2-213	1F 21	B 6
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RMI VHF NAV1 IND		1R 34	C 6
COMPASS COUPLER 1 SUP		1F 130	F 8
VOR VHF NAV1 SUP		1R 33	G 7
FLT CONT & NAV BUS		X 355	H 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No.2 INPH SUP	3-213	R 90	H 2
RMI VHF NAV2 IND	13-216	2R 34	A19
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 S & IND		2F 21	C15
COMPASS COUPLER 2 NORMAL SUP		2F 130	D15
RH DASH INST LTS SUP		L 371	E 9
VOR VHF NAV2 SUP		2R 33	E14
NAV INST BUS		X 345	G 4
LH DASH INST LTS SUP	13-215	L 372	A12
CTR DASH & GLARE SHIELD	14-216	L 375	D10
COMPASS COUPLER SYST2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV1 & DEV2 2ND PLT SUP		2R 38	F21

(4) On 5-211 make certain that function selector switches on VOR/ILS/DME 1 and 2 control units are in STBY position.
- On AFCS control unit (C 1) make certain that no mode is engaged.
- Place two RAD/INS switches in RAD position.

(5) Put into operation INS 1 and 2 according to chapter 34-45-00, Adjustment/Test.

(6) In zone 8-214 make certain that DG/MAG switches on COMPASS COUPLER control panel are in MAG position.

(7) On Captain instrument panel place switches :

(1F 7) ATT/INS 1/INS 2 in INS 1 position
(1F 133) COMP 1/COMP 2 in COMP 1 position

(1R 26) DEV 1/DEV 2 in DEV 1 position
(1F 33) NAV/INS 1/INS 2 in INS 1 position

(8) On First Officer instrument panel place switches :

(2F 7) ATT/INS 2/INS 2 in INS 2 position
(2F 133) COMP 1/COMP 2 in COMP 2 position
(2R 26) DEV 1/DEV 2 in DEV 2 position
(2F 33) NAV/INS 1/INS 2 in INS 2 position

(9) Using GLARESHIELD LIGHTING INST selector, L 402 on 4-211, check that control panel lighting varies. Switch off lighting.

(10) Check correct operation of HSI, RMI and ADI lighting. By means of RH DASH INST (5-211) and LH DASH INST (5-212) selectors check that lighting varies. Place selectors in OFF position.

(11) On Captain jack panel
- make certain that boom set is connected or connect a boom set.
  On audio selector panel, engage NAV 1 and 2 push button.

C. VOR Test

(1) VOR 1 system

(a) On VOR/ILS/DME 1 control unit, select a local VOR frequency.
- Using headset, check that audio signal is received from VOR beacon.
- On Captain HSI, NAV flag disappears, ANG annunciator appears, RAD, MAG and 1 annunciators are visible, TO or FROM arrow appears, HDG flag is not visible.
- On Captain and First Officer RMI/VOR, VOR 1 flag disappears, single pointer indicates direction of the station, HSI and RMI heading dials indicate magnetic heading.

(b) On 5-211 on AFCS control unit (C 1), centre lateral deviation bar by means of VOR/LOC REF. No.1 button.
- Single pointers on RMI indicators are positioned at NORTH on heading dials.

(c) On VOR/ILS/DME 1 control unit (1R 28), press and hold TEST NAV push button :
- On Captain HSI :

NAV flag appears, lateral deviation bar centres or remains centred. After approximately 7 seconds NAV flag disappears, lateral deviation bar moves to stop and then recentres, TO-FROM arrow reverses then returns to its initial position. After approximately 12 seconds, VOR 1 flag appears, single pointer indicates 180°.

(d) Release TEST selector switch on VOR/ILS/DME 1 control unit.
- Initial indications reappear on indicators.

(2) VOR 2 system

(a) On VOR/ILS/DME 2 control unit select a local VOR frequency.
- Using headset, check that audio signal is received from VOR beacon.
- On First Officer HSI, NAV flag disappears, ANG annunciator appears, RAD, MAG and 2 indications are visible, TO or FROM arrow appears, HDG flag is not visible.
- On Captain and First Officer RMI/VOR indicators, VOR 2 flag disappears ; the double pointer indicates the direction of the station.

(b) On AFCS control unit (C 1), by means of VOR/LOC REF No.2 button, centre lateral deviation bar.
- Single pointers on RMI indicators are positioned at NORTH on heading dials.

(c) On VOR/ILS/DME 2 control unit, place and hold TEST selector switch in VOR position
- On First Officer HSI :
NAV flag appears, lateral deviation bar remains centred.
After approximately 7 seconds NAV flag disappears, lateral deviation bar moves to stop TO-FROM arrow reverses.
After approximately 12 seconds TO or FROM arrow disappears, NAV flag reappears.
- On Captain and First Officer RMI/VOR :
VOR 2 flag appears then disappears. After approximately 7 seconds double pointer is positioned at 180°. After approximately 12 seconds VOR 2 flag appears, double pointer indicates 180°.

(d) Release TEST selector switch on VOR/ILS/DME 2 control unit.
- Initial indications reappear on indicators.

D. Close-Up

(1) Switch off electronics rack ventilation system (Ref. 21-21-00).

(2) On Captain audio selector panel engage NAV 1 and 2 push buttons, place volume controls in minimum position.

(3) Remove boom set from Captain jack panel if necessary.

(4) Place MSU 1 and 2 selector switches in OFF position in order to switch off INS systems.

(5) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(6) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
VOR/ILS Ground Test Unit (Cossor or equivalent)	
Boom Set (from Ground Test Unit)	TE2037000

B. Prepare

(1) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Page 301, Servicing).

(2) Switch on electronics rack ventilation system (Ref. 21-21-00).

(3) Make certain that the following circuit breakers are set :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1ST PLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
DEV1 & DEV2 1ST PLT SW SUP		1R 38	G14
ATT/INS 1ST PLT SW SUP		1F 13	G16
RAD/INS 1ST PLT SW SUP		1F 26	G17
No.1 INPH SUP		R 89	K19
HSI TRUE 1ST PLT INS1 SUP & IND	2-213	1F 21	B 6
HSI MAG 1ST PLT INS1 SUP & IND		1F 16	B 8
RMI VHF NAV1 IND		1R 34	C 6
COMPASS COUPLER 1 SUP		1F 130	F 8
VOR VHF NAV1 SUP		1R 33	G 7
FLT CONT & NAV BUS		X 355	H 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No.2 INPH SUP	3-213	R 90	H 2
RMI VHF NAV2 IND	13-216	2R 34	A19
HSI MAG 2ND PLT INS2 SUP & IND		2F 16	C14
HSI TRUE 2ND PLT INS2 S & IND		2F 21	C15
COMPASS COUPLER 2 NORMAL SUP		2F 130	D15
RH DASH INST LTS SUP		L 371	E 9
VOR VHF NAV2 SUP		2R 33	E14
NAV INST BUS		X 345	G 4
LH DASH INST LTS SUP	13-215	L 372	A12
CTR DASH & GLARE SHIELD	14-216	L 375	D10
COMPASS COUPLER SYST2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV1 & DEV2 2ND PLT SW SUP		2R 38	F21

(4) On 5-211, make certain that function selector switches on VOR/ILS/DME 1 and 2 are in STBY position.
- On AFCS control unit (C 1), make certain that no mode is engaged.
- Place two RAD/INS switches in RAD position.

(5) Put into operation INS 1 and 2 according to chapter 34-45-00, Adjustment/Test.

(6) In zone 8-214 make certain that DG/MAG switches on COMPASS COUPLER control panel are in MAG position.

(7) On Captain instrument panel (2-211) place switches :

(1F 7) ATT/INS 1/INS 3 in INS 1 position
(1F 133) COMP 1/COMP 2 in COMP 1 position
(1R 26) DEV 1/DEV 2 in DEV 1 position

(1F 33) NAV INS 1/INS 2 in INS 1 position

(8) On First Officer instrument panel (2-212) place switches :

(2F 7) ATT/INS 2/INS 3 in INS 2 position
(2F 133) COMP 1/COMP 2 in COMP 2 position
(2R 26) DEV 1/DEV 2 in DEV 2 position
(2F 33) NAV/INS 1/INS 2 in INS 2 position

(9) Using GLARESHIELD LIGHTING INST selector - L 402 on 4-211 - check that control panel lighting varies. Switch off lighting.

(10) Check correct operation of HSI, RMI and ADI lighting. By means of RH DASH INST (5-211) and LH DASH INST (5-212) selectors check that lighting varies. Place selectors in OFF position.

(11) Use VOR/ILS ground test unit. Switch it on.

C. Test

(1) VOR 1 system

(a) On ground test unit place function selector switch in VOR position, VOR INCREMENTAL in 0 position, VOR BEARING in 0 position.

(b) Select ground test unit working frequency on VOR/ILS/DME 1 control unit.
- On Captain HSI, HDG flag is not visible, RAD, MAG and 1 indications are visible, NAV flag is not visible.
- On Captain and First Officer RMI/VOR, COMPASS flag is not visible, indicator heading dials indicate magnetic heading, VOR 1 flag is not visible.

(c) On AFCS control unit (C 1) by means of VOR/LOC REF 1 button centre Captain HSI lateral deviation bar, reading in corresponding window, is 0 ± 5° or 180 ± 5°.
- On Captain HSI, reference pointer indicates same value, TO arrow appears for 0 ± 5°, FROM arrow appears for 180 ± 5°.
- On Captain and First Officer RMI/VOR, VOR 1 flag is not visible, single needle is positioned at NORTH on heading dial.

(d) On AFCS control unit 1 (C 1) turn VOR/LOC REF 1

button in increase sense.
- Captain HSI lateral deviation bar deviates left.

(e) Turn VOR/LOC REF 1 button in decrease sense
- Captain HSI lateral deviation bar deviates right. Recentre bar.

(f) On VOR ground test unit place BEARING selector switch in 135° position then centre deviation bar on Captain HSI by means of VOR/LOC REF 1 button on AFCS control unit (C 1).
- Reading in corresponding window is 135 ± 5° or 315 ± 5°.
- On Captain HSI, reference track pointer indicates same value, TO arrow appears for 135 ± 5°, FROM arrow appears for 315 ± 5°.
- On Captain and First Officer RMI/VOR, VOR 1 flag is not visible, single pointer indicates 135 ± 7°.

(g) On VOR ground test unit place BEARING selector switch in 270° position, place DEV 1/DEV 2 switch on First Officer instrument panel (2-212) in DEV 1 position.
- On First Officer HSI indications are identical with those of Captain HSI.
- By means of VOR/LOC 1 button on AFCS control unit (C 1) centre lateral deviation bar on HSI indicators, reading in corresponding window is 270 ± 5° or 90 ± 5°.
- On HSI indicators reference track pointers indicate same values, TO arrow appears for 270 ± 5°, FROM arrow appears for 90 ± 5°.
- On Captain and First Officer RMI, VOR 1 flag is not visible, single pointer indicates 270 ± 7°.

(h) On VOR ground test unit return BEARING selector switch in 0 position ; centre HSI lateral deviation bars by means of VOR/LOC 1 button on AFCS control unit (C1).
- reading in corresponding window is 0 ± 5° or 180 ± 5°.
- on HSI's, reference track pointers indicate same value. TO arrow appears for 0 ± 5° ; FROM arrow appears for 180° ± 5°.
- on Captain and First Officer RMI/VOR, VOR flag is not visible, single pointer indicates 0 ± 7°.

(i) Place DEV 1/DEV 2 switch on instrument panel in DEV 2 position.
- First Officer HSI indications disappear.

(2) VOR 2 system

(a) On VOR/ILS/DME 2 control unit, select ground test unit working frequency.
- On First Officer HSI, RAD, MAG, 2 and ANG indications are visible, HDG flag and NAV flag are not visible.
- On Captain and First Officer RMI/VOR, COMPASS flag is not visible, HSI and RMI indicator heading dials indicate magnetic heading, VOR 2 flag is not visible.

(b) Repeat VOR 1 test, paragraph C (c) reading :
- VOR/LOC REF 2 button in place of REF 1, First Officer HSI in place of Captain HSI, DEV 1/ DEV 2 in DEV 2 position. On RMI indicators, double pointer in place of single pointer. Check on the two receivers.

(3) Reception

(a) On Captain and First Officer jack panels make certain that boom set is connected or connect a boom set to BOOM SET connector.

(b) On Captain and First Officer audio selector panels, engage NAV 1 and 2 push buttons, place volume control in maximum position.

(c) On VOR/ILS ground test unit, place identification signal selector switch in ON position.

(d) Check that AUDIO signal is successively transmitted to each boom set ; check that sound level varies by operating volume control on audio selector panels.

D. Close-Up

(1) Switch off ground test unit.

(2) Switch off electronics racks ventilation system (Ref. 21-21-00).

(3) On Captain and First Officer audio selector panels, engage VOR/ILS/DME push buttons, turn volume control to minimum.

(4) Remove boom set from Captain and First Officer jack panels if necessary.

(5) Place MSU 1 and 2 selector switches in OFF position in order to switch off INS systems.

(6) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FLT CONT & NAV BUS 14XS	2-213	X 355	H 2
NAV INST BUS 13XS	13-216	X 345	G 4

(7) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

3. System Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	
VOR/ILS Ground Test Unit (Cossor or equivalent)	
SWR Meter (Ferisol TOZ01A or Equivalent)	
SWR Measurement Cable	
Boom Set (from Ground Test Unit)	TE2037000

B. SWR Measurement

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
VOR VHF NAV 1 SUP	2-213	1R 33	G 7
VOR VHF NAV 2 SUP	13-216	2R 33	E14

(2) Remove VOR 1 receiver from shelf 7-215.

(3) By means of SWR measurement cable connect SWR meter to coaxial terminal A2 on connector 1R24AA.

(4) Measure and note SWR value at frequency of 115 MHz, value must be maximum 5.

(5) Disconnect cable, install VOR 1 receiver in its rack.

(6) Remove VOR 2 receiver from shelf 5-216.

(7) By means of SWR measurement cable connect SWR meter to coaxial terminal A2 on connector 2R24AA.

(8) Measure and note SWR value at frequency of 115 MHz, value must be maximum 5.

(9) Disconnect cable, install VOR 2 receiver in its rack.

C. Test

Refer to functional test, paragraph 2 for test procedure.

D. Close-Up

(1) Refer to functional test, paragraph 2. D. for close-up procedure.

R VOR/LOC ANTENNA COUPLER - INSPECTION/CHECK

1. General

Installation of the VOR/LOC antenna couplers in a zone subject to intense vibration makes necessary inspection of the locking lugs on the coupler connectors and locking of aircraft side coaxial cable connector nuts.

2. Inspection/Check of VOR/LOC Antenna Couplers

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform 11.25 m (36 ft. 11 in.)	
Circuit Breaker Safety Clips	

B. Prepare

(1) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ILS VHF NAV SUP	2-213	1R 25	G 6
VOR VHF NAV SUP		1R 33	G 7
ILS VHF NAV SUP	13-216	2R 25	E14
VOR VHF NAV SUP		2R 33	E15

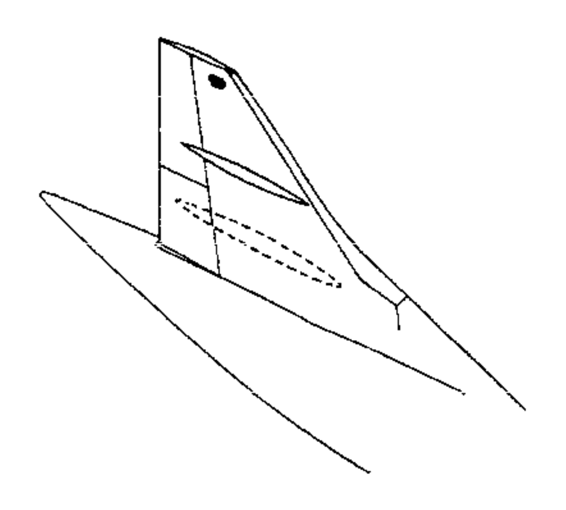
(2) Install access platform at aircraft fin.

R C. Remove Couplers (Ref. Fig. 601 and 602).

(1) Coupler No.1
Coupler No.1 is installed on a packing block inside the fin, below coupler No.2. Access to the coupler is gained by removing access door QR323.

(a) Loosen the eleven screws securing access door QR323.

(b) Remove door, disconnect the three coupler connectors (Note cable sleeve identifiers and connector markers).



OPENING IN FIN FOR ANTENNA CONNECTION

REINFORCEMENT ON RH SIDE OF FIN

COUPLER No. 2 MOUNTED TRANSVERSALLY IN FIN LEADING EDGE

RIB23

PACKING BLOCK

MOUNTING SCREWS

2R29B

1R29B

2R29A

2R198

CABLE ASSY

1R29A

1R198

1R198C

1R198A

1R198B

MOUNTING NUT

RIB22

ANTENNA VOR/LOC No. 1 INTERCONNECTION

COUPLER No. 1 MOUNTED TRANSVERSALLY IN FIN LEADING EDGE

ACCESS DOOR QR323 COVERING OPENING IN FIN

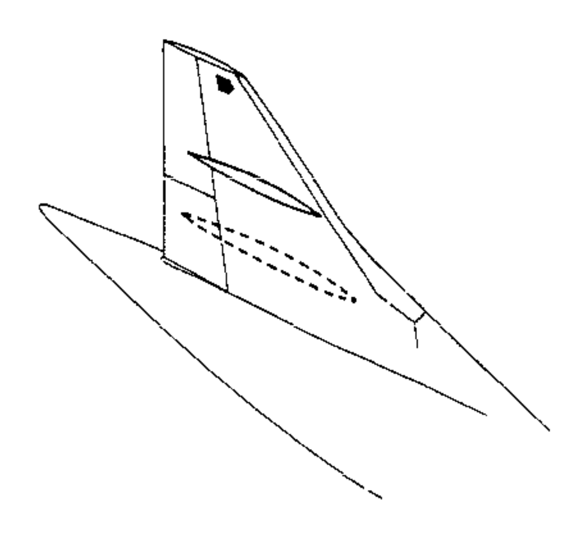
FWD

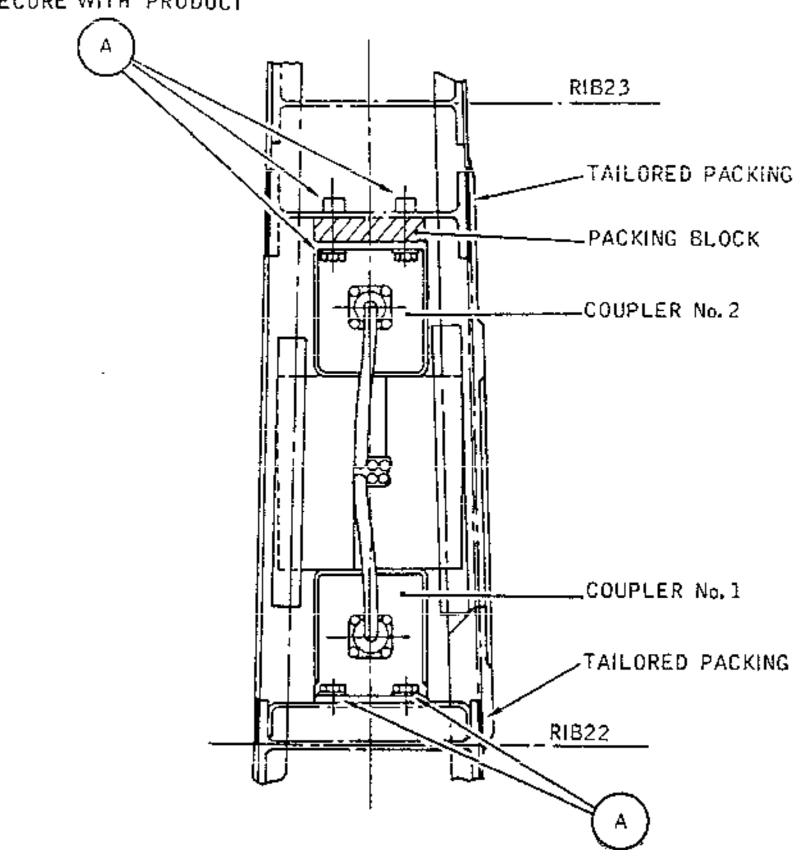
VIEW ON RH SIDE OF FIN

CMA 34 55 00 6 ACMO

View of Coupler Mounting Position - Access Door
Figure 601

R





Location of Two Hybrid Couplers Mounted in Fin
Figure 602

(c) Loosen and remove the four bolts, nuts and washers securing coupler to packing block.

(d) Remove coupler for check.

(2) Coupler No.2
Coupler No.2 is attached to a packing block on a mounting inside the fin by 4 screws. Removal of access door QR 323 provides access to the coupler.

(a) Disconnect the three connectors from coupler (Note cable sleeve identifiers and connector markers).

(b) Loosen and remove the four bolts, nuts and washers securing coupler.

(c) Remove coupler for check.

D. Check

Check wear on connector locking lugs. Replace coupler if wear exceeds 0.2 mm (0.008 in.).

E. Install Couplers

Check assembly for correct mechanical condition, and check condition of connectors.
(Ref. Fig. 601)

(1) Coupler No.2

(a) Install and secure coupler No.2 by means of the four mounting bolts, nuts and washers. (Do not forget to install packing block).

(b) Check on aircraft coaxial cables that connector locknut is torqued to 310 to 368 lbf. in. (3.5 to 4.5 mdaN).

(c) Connect the three coaxial cables to the three coupler connectors, according to identifiers.

(2) Coupler No.1

(a) Install and secure coupler No.1 by means of the four mounting bolts, nuts and washers.

(b) Check on aircraft coaxial cables that connector locknut is torqued to 310 to 368lbf. in. (3.5 to 4.5 mdaN).

(c) Position access door QR323, connect the three coaxial cables to the three coupler connectors, according to identifiers.

(d) Install access door QR323 in its housing, and secure with the eleven screws.

F. Test

Carry out a functional test (Ref. 34-55-00, Adjustment/Test).

G. Close-Up

Remove access platform.

VOR/LOC ANTENNA - REMOVAL/INSTALLATION

1. General

Removal/Installation for regular scheduled inspection or when an operational fault is located. The antenna consists of two identical half antennas mounted symmetrically on the outside of the fin on the RH and LH sides, near the top, level with rib 23. Access door 323QR, on the RH side of the fin below the RH half-antenna is opened to gain access to the two hybrid couplers transversally mounted in the fin.

2. VOR/LOC Antenna

A. Equipment and Materials

DESCRIPTION	PART NO.
Access Platform to fin (access height 11.25 m - 36 ft. 11 in.)	
Circuit Breaker Safety Clips	
4 Coaxial Connector Blanking caps	
Special Materials (Ref. 20-30-00, No. 111)	
Glues and Adhesives (Ref. 20-30-00, No. 317)	
Sealants (Ref. 20-30-00, No. 353)	

B. Prepare

(1) Position access platform at fin.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ILS VHF NAV 1 SUP	2-213	1R 25	G 6
VOR VHF NAV 1 SUP		1R 33	G 7
ILS VHF NAV 2 SUP	13-216	2R 25	E14
VOR VHF NAV 2 SUP		2R 33	E15

C. Remove (Ref. Fig. 401)

(1) Gain access to half-antenna (1), loosen 8 base mounting screws (2) (4 upper, 4 lower) remove screws and washers (3), while supporting antenna.

(2) Disengage base from its mounting on the fin, disconnect the two coaxial connectors, remove antenna.

(3) Blank off coaxial connectors on antenna and feeders.

D. Install

(1) Prepare

Make certain of correct mechanical condition, condition of paint and connectors, on replacement antenna.
Make certain that base is clear of protective material.
Clean inner surfaces and countersunk seating of fin mounting screw washers. Make certain that fin contact surface with base is clean.
Coat ends of threads on fin with a small quantity of product No.111.

(2) Position antenna base facing its mounting, connect the two coaxial connectors, correctly identifying the coaxial cables going to the couplers.

(3) Commence mounting of antenna on fin, installing each screw and washer. Tighten screws.

R (4) Carry out a bonding test between the aerial and
R adjacent structure in accordance with MM 20-27-11
R using a current of 10A.

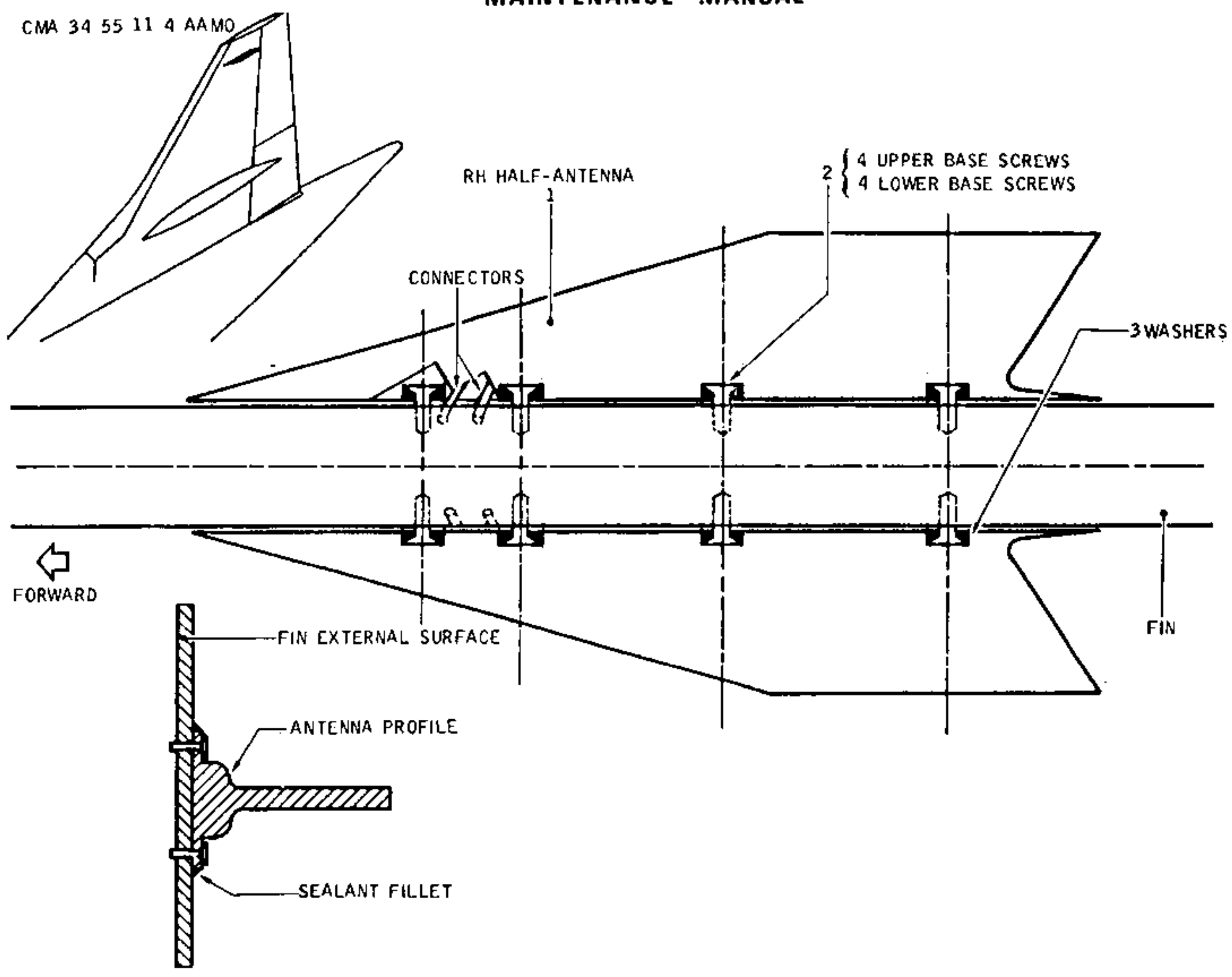
R (5) Apply protective products No. 317 and 353, forming around the base an anti-corrosion bead.

3. Test

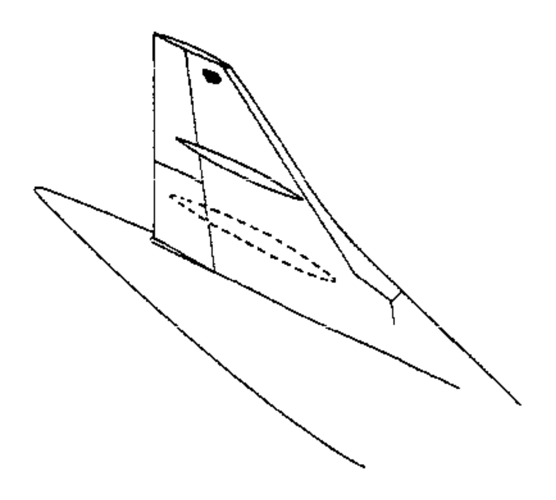
A. Carry out functional test (Ref. 34-55-00, Adjustment/Test).

4. Close-Up

A. Remove access platform from fin.



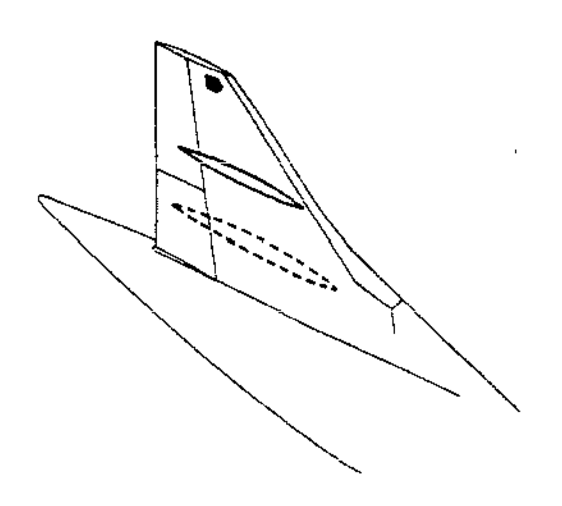
VOR/LOC antenna - mounting details
Figure 401

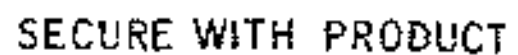


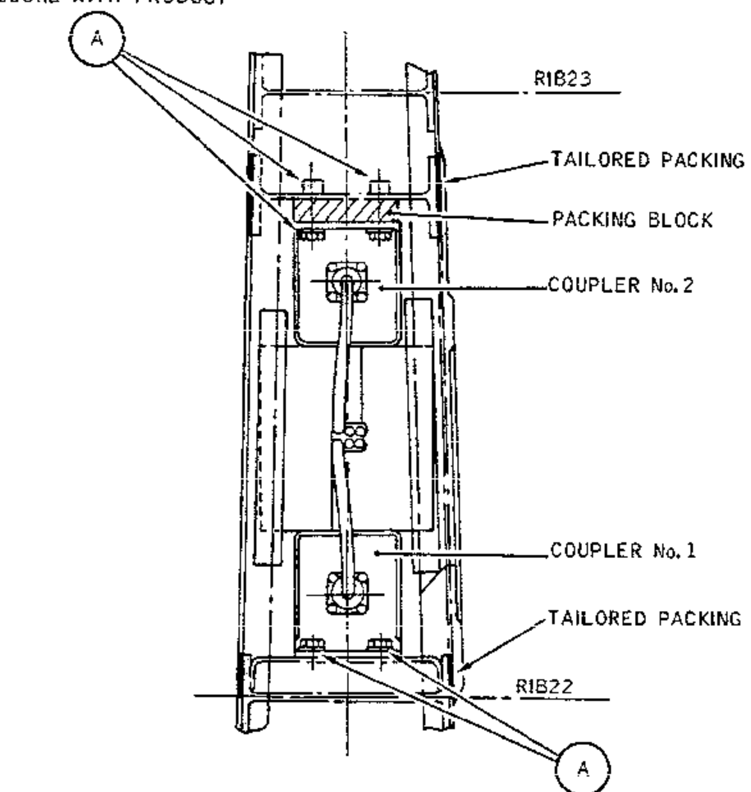
OPENING IN FIN FOR ANTENNA CONNECTION
REINFORCEMENT ON RH SIDE OF FIN
COUPLER No. 2 MOUNTED TRANSVERSALLY IN FIN LEADING EDGE
RIB23
PACKING BLOCK
MOUNTING SCREWS
2R29B
1R29B
2R29A
2R198
CABLE ASSY
1R29A
1R198
1R198C
1R198A
1R198B
MOUNTING NUT
RIB22
ANTENNA VOR/LOC No. 1 INTERCONNECTION
COUPLER No. 1 MOUNTED TRANSVERSALLY IN FIN LEADING EDGE
ACCESS DOOR QR323 COVERING OPENING IN FIN
VIEW ON RH SIDE OF FIN
FWD

CMA 34 55 11 4 ACMO

R View of Coupler Mounting Positions - Access Door
Figure 402







CMA 34 55 11 4 AEMO

Location of Two Hybrid Couplers Mounted in Fin
Figure 403

(2) Remove access door QR323.

(3) Disconnect three coaxial cables from coupler.

(4) Loosen and remove the four coupler attachment nuts, bolts and washers from bracket or packing block.

(5) Remove coupler.

C. Install coupler

(1) Prepare

- make certain that coupler is in correct mechanical condition and check condition of connectors.

(2) Position coupler on mounting and attach by means of the four nuts, bolts and washers. Secure nuts and bolts with Loctite.

(3) Connect the three coaxial cables.

(4) Install access door QR323 by means of 11 attachment screws.

4. Test

A. Carry out functional test (Ref. 34-55-00, Adjustment/Test).

5. Close-Up

A. Remove access platform from fin.

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VOR/ILS/DME CONTROL UNITS 1R28 & 2R28
REMOVAL/INSTALLATION

1. General

VOR/ILS/DME control units 1R28 and 2R28 are installed respectively to the right and to the left of glareshield panel 5-211.

2. Removal/Installation

As the VOR/ILS/DME control units are identical, removal/installation of VOR/ILS/DME control unit No.1 1R28 only will be described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	

B. Prepare

(1) Trip the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DME 1 IND	2-213	1S 3	C 8
DME 2 SUP		1S 4	E 7
ILS VHF NAV1 SUP		1R 25	G 6
VOR VHF NAV1 SUP		1R 33	G 7
LH DIGITAL DISPLAY	15-215	L1211	G14
DIMMING SUP DME2 IND	13-216	2S 3	B19
VOR VHF NAV2		2R 33	E14
ILS VHF NAV2		2R 25	E15
DME2 SUP		2S 4	G19
CTR DASH & G/SHIELD INST LTS SUP	14-216	L 375	D10
RH DIGITAL DISPLAY DIMMING SUP	15-216	L1216	A13

(2) On panel 4-211, place GLARESHIELD LIGHTING INST rotary switch in OFF position.

(3) On panel 1-211 (1-212), place DIGITS POTENTIOMETER in OFF position.

(4) Make certain that function selector on VOR/ILS/DME No.1 (No.2) control unit is in S/B position.

C. Remove VOR/ILS/DME control unit No.1 1R28.

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.D.

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 3.F.

F. Close-Up

(1) Carry out a VOR1(VOR2) test (Ref. 34-55-00, Adjustment/Test, Operational Test).

(2) Carry out an ILS1(ILS2) test (Ref. 34-36-00, Adjustment/Test, Operational Test).

(3) Carry out a DME1(DME2) test in self-test mode (Ref. 34-51-00, Adjustment/Test, Operational Test).

DEV1 - DEV2 - SWITCH - REMOVAL/INSTALLATION

1. General

Captain DEV1 - DEV2 switch 1R26 is located on Captain instrument panel, panel 2/2 -211.
First Officer DEV1 - DEV2 switch 2R26 is located on First Officer instrument panel, panel 4/2 - 212.

2. Removal/Installation

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	

B. Prepare

(1) Trip, Safety and Tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NAV/INS 1STPLT SW SUP	1-213	1F 34	E15
COMPASS COUPLER SYS1 SW SUP		1F 134	F14
DEV1 & DEV2 1STPLT SW SUP		1R 38	G14
ATT/INS 1STPLT SW SUP		1F 13	G16
RAD/INS 1STPLT SW SUP		1F 26	G17
COMPASS COUPLER SYS 2 SW SUP	15-216	2F 134	A21
NAV/INS 2ND PLT SW SUP		2F 34	C 2
ATT/INS 2ND PLT SW SUP		2F 13	D21
RAD/INS 2ND PLT SW SUP		2F 26	E21
DEV1 & DEV2 2ND PLT SW SUP		2R 38	F21

C. Remove DEV1 - DEV 2 switch

(1) Refer to 33-16-00, Removal/Installation, for electroluminescent (EL) panel.

(2) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

D. Preparation of Replacement Component

Not applicable.

E. Install

(1) Refer to 33-10-00, Removal/Installation, for typical toggle switch.

(2) Refer to 33-16-00, Removal/Installation, for EL panel.

F. Tests

(1) Refer to 33-10-00, Adjustment/Test, Close-Up for typical toggle switch.

(2) Check switch operation by carrying out DEV1 - DEV2 switch test procedures (Ref. 34-55-14, Adjustment/Test).

(3) Refer to 33-16-00, Removal/Installation, paragraph 2.G (1) through (5) for EL panel.

G. Close-Up

(1) Refer to 34-55-14, Adjustment/Test, Paragraph 2.D.

DEV1 - DEV2 SWITCH - ADJUSTMENT/TEST

1. General

Test to be carried out following removal/installation.

A. Of a RAD INS/VOR ILS switching unit 1F24 or 2F24.

B. Of a DEV1 - DEV2 switch.

C. Of a RAD - INS switch.

2. Adjustment/Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Electrical Ground Power Unit	

B. Prepare

(1) ILS start-up

(a) Refer to 34-36-00, Adjustment/Test, Operational Test, paragraphs 1.A., 1.B.

C. Check of VOR ILS Switching Unit and DEV1 - DEV2 Selector Switch.

(1) DEV1

(a) Refer to 34-36-00, Adjustment/Test, Operational Test, paragraph 1.C. (1).

(2) DEV2

(a) On Captain and First Officer instrument panels, place DEV1 - DEV2 switches in DEV2 position.

(b) Refer to 34-36-00, Adjustment/Test, Operational Test, paragraph 1.C (2) (a).

D. Close-Up

(1) Refer to 34-36-00, Operational Test, paragraph D.

RMI/VOR INDICATOR - REMOVAL/INSTALLATION

1. General

Two indicators are installed, on the Captain (2-211) and First Officer (2-212) instrument panels. The indicators cannot be directly withdrawn from the front of the instrument panels because of insufficient wiring length.

2. Removal/Installation

A. Equipment and Materials.

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	

B. Prepare

(1) On Captain and First Officer side panels 12-211 and 5-212, make certain that LH and RH DASH INSTRUMENTS knobs are in OFF position.

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
COMPASS COUPLER SYST 1 SW SUP	1-213	1F 134	F14
RMI VHF NAV1 IND	2-213	1R 34	C 6
COMPASS COUPLER 1 SUP		1F 130	F 8
VOR VHF NAV 1 SUP		1R 33	G 7
LH DASH INST LTS SUP	13-215	L 372	A12
COMPASS COUPLER 2 STBY		2F 131	B 7
RMI VHF NAV 2 IND	13-216	2R 34	A19
COMPASS COUPLER 2 NORMAL SUP		2F 130	D15
RH DASH INST LTS SUP		L 371	E 9
VOR VHF NAV 2 SUP		2R 33	E14
COMPASS COUPLER 2 SYST 2	15-216	2F 134	A21

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SW SUP			

C. Remove (Ref. Fig. 401)

(1) Loosen and remove the four adaptor plate (3) mounting screws (4).

(2) Remove adaptor plate (3).

(3) Carefully remove RMI/VOR indicator (2) from its seating (8). Support indicator.

(4) Under instrument panel, disconnect connector (7) from indicator.

(5) Withdraw indicator (2).

(6) Cap electrical connectors (6) and (7).

D. Preparation of replacement component.

(1) Make certain that indicator seating is clean and that connectors and aircraft wiring are in correct condition.

(2) Visually check indicator for correct external condition, that connector is undamaged and has no traces of corrosion.

E. Install

(1) Remove blanking caps from connectors (6) and (7).

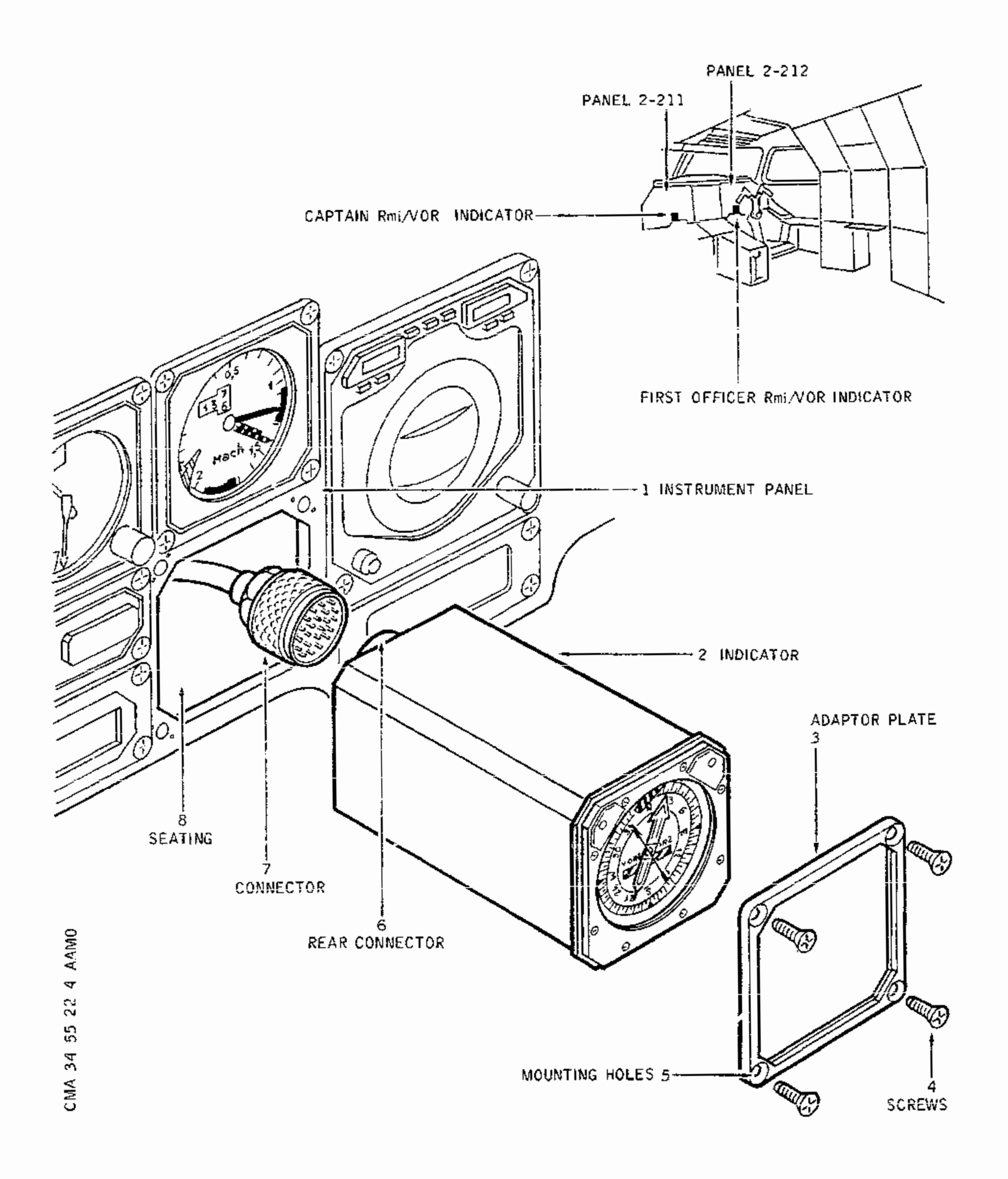
(2) Position indicator (2) facing its seating (8) and carefully install.

(3) Under instrument panel, connect aircraft connectors (7) to indicator receptacles (6).

(4) Push indicator (2) fully against instrument panel (1).

(5) Position adaptor plate (3) and install and tighten 4 mounting screws (4) in adaptor plate holes.

F. Tests



Removal/Installation of an RMI/VOR Indicator
Figure 401

(1) Remove safety clips and tags and reset circuit breakers previously tripped in paragraph 2-B-(2).

(2) Connect electrical ground power unit and energize the aircraft electrical network (Ref. 24-41-00, Servicing).

(3) Switch on electronics rack ventilation system (Ref. 21-21-00).

(4) Adjust LH and RH DASH INSTRUMENTS potentiometers on panels 12-211 and 5-212 to obtain correct illumination of indicator face.

(5) Panel 5-211 (5-212), on Captain (First Officer) VOR-ILS-DME control unit, place and hold TEST selector in VOR position and check on RMI-VOR indicators that :

(a) VOR1 (VOR2) flag appears and disappears after approximately 7 seconds

(b) The single pointer is positioned at 180°

(c) VOR1 (VOR2) flag appears after approximately 12 seconds.

(d) Single pointer indicates 180°.

(6) On Captain (First Officer) VOR-ILS-DME control unit, release TEST selector and check on RMI/VOR indicators that :

(a) Single pointer returns to its initial position.

(b) VOR flags are visible.

G. Close-up

(1) On side panels 12-211 and 5-212, place LH and RH DASH INSTRUMENTS knobs in OFF position.

(2) Switch off electronics rack ventilation system (Ref. 21-21-00).

(3) De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, Servicing).

VOR RECEIVERS 1R24 & 2R24 - REMOVAL/INSTALLATION

1. General

VOR1 receiver 1R24 is installed on shelf 7-215.
VOR2 receiver 2R24 is installed on shelf 5-216.

2. Removal/Installation

As the VOR receivers are identical, removal/installation of VOR1 receiver 1R24 only will be described.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps	
Ventilation Outlet Blanking Plate	

B. Prepare

(1) Remove panel DS from shelf 7-215 (panel ES from shelf 5-216 for receiver 2R24).

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DEV1 & DEV2 1STPLT SW SUP	1-213	1R 38	G14
VOR VHFNAV1 SUP	2-213	1R 33	G 7
VOR VHFNAV2 SUP	13-216	2R 33	E14
DEV1 & DEV2 2NDPLT SW SUP	15-216	2R 38	F21

(3) On panel 5-211, make certain that S/B-DME-OVRD function selectors on Captain and First Officer VOR-ILS-DME control units are in S/B position.

C. Remove VOR1 Receiver

(1) Gain access to shelf 7-215 (shelf 7-216 for receiver 2R24).

(2) Refer to 34-00-00, Removal/Installation, paragraph 2.D.(1).

D. Preparation of Replacement Component

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.E.

E. Install

(1) Refer to 34-00-00, Removal/Installation, paragraph 2.F.(1).

F. Tests

(1) Carry out a test of VOR receiver installed.

(2) Carry out a VOR test (Ref. 34-55-00, Adjustment/Test, Operational Test).

G. Close-Up

(1) Install panel DS on shelf 7-215 (panel ES on shelf 5-216 for receiver 2R24).

RF SWITCH - REMOVAL/INSTALLATION

1. General

The signals from each of the VOR/LOC half-antennas are routed to the VOR or ILS receivers via RF switches 1R31 for system 1 and 2R31 for system 2.
Each RF Switch is controlled by the system VOR/ILS/DME control unit.
In the de-energized position the RF switch switches the VOR/LOC half-antenna to the corresponding VOR receiver. RF switch 1R31 is mounted on a removable plate located on the shelf, the RF switch coaxial output connectors are in a housing at the rear of the shelf. The RF switch is mounted behind the VOR and ILS receivers with its centre line approximately between the two receivers. RF switch 1R31 is on shelf 7-215. RF switch 2R31 is on shelf 5-216.

2. Removal/Installation

The RF switches are identical and only 1R31 Removal/Installation procedure is described.

A. Equipment

DESCRIPTION	PART NO.
Circuit Breaker Safety Clips	
Blanking Caps for Electrical Connectors	
Blanking Cap for Ventilation Outlet	

B. Prepare

(1) Remove panel DS on shelf 7-215 (ES on shelf 5-216 for 2R31).

(2) Trip, safety and tag the following circuit breakers :

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DEV1 & DEV2 1ST PLT SW SUP	1-213	1R38	G14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
DEV1 & DEV2 2ND PLT SW SUP	15-216	2R38	F21

C. Remove (Ref. Fig.401 and 402)

(1) Remove VOR and ILS1 receivers :

(a) Loosen retaining nuts, free spindles from studs.

(b) Lower retaining nut spindles.

(c) Pulling on handle, release receiver from rear connectors, withdraw receiver from rack.

(2) Cap connectors and ventilation outlets.

(3) Gain access to RF switch 1R31(1) mounting plate.

(a) Completely remove the two securing crews (3) from mounting plate (2) on shelf.

(b) Disconnect the two RF switch control wires (7) from solder tags.

(c) Completely remove securing screws from relay UM2634(4), remove relay from mounting plate. Retain screws.

(d) Raise plate to gain access to the the two coaxial connectors (5) withdrawn from their housing on shelf.

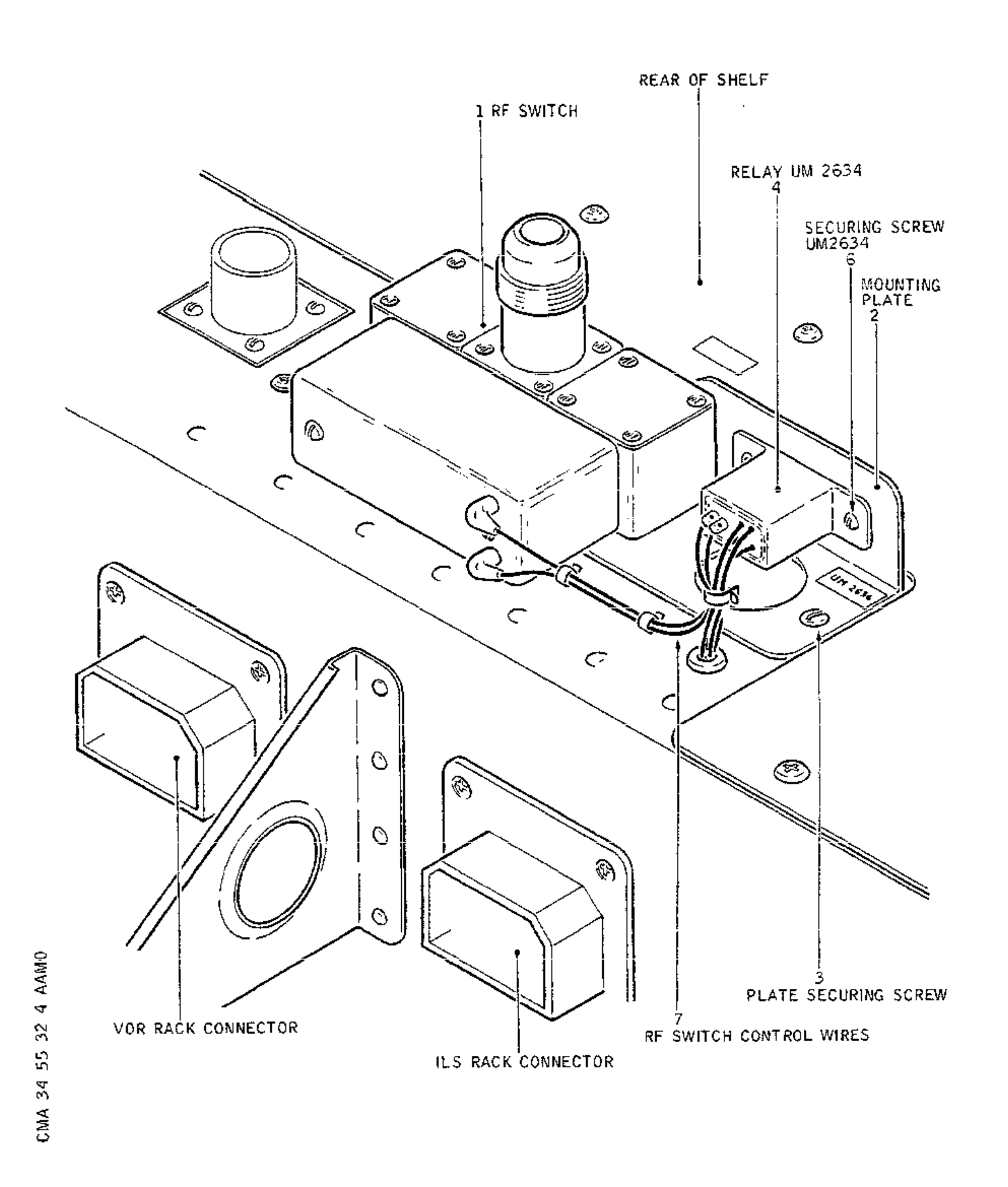
(e) Remove the two lower coaxial connectors (5), place identifiers on coaxial cables.

(f) Remove mounting plate (2) for replacement of RF switch.

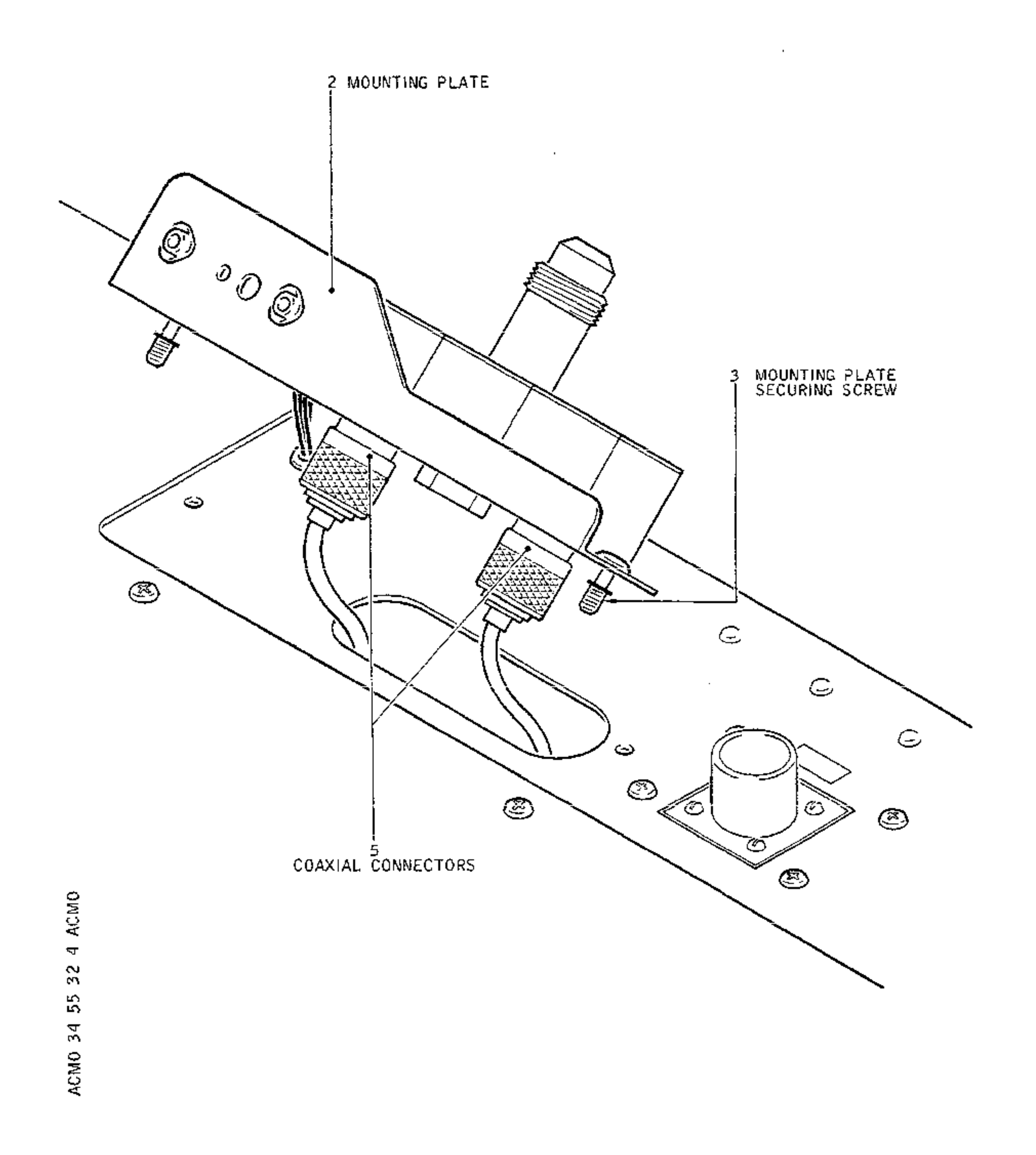
D. Preparation of Replacement Component

(1) Remove RF switch (1) from mounting plate (2).

(2) Prepare, position and install replacement RF switch on mounting plate (2).



RF Switch and Mounting Plate
Figure 401



Mounting Plate : Removal of Coaxial Connectors
Figure 402

E. Install

(1) Position mounting plate fitted with RF switch on its mounting on shelf.

(2) Position and install relay UM2634 with its two screws (6).

(3) Identify and connect the two RF switch control wires (7) to the two solder tags.

(4) Position the RF switch body in its housing, identify and connect the two coaxial connectors (5).

(5) Install relay mounting plate (2) on shelf by means of two screws (3).

3. Tests

A. Perform a VOR system functional test (Ref. 34-55-00, Adjustment/Test).

B. Perform an ILS system functional test (Ref. 34-36-00, Adjustment/Test).

4. Close-Up

Install panel DS on shelf 7-215 (ES on shelf 5-216 for 2R31).

END OF THIS
SECTION

NEXT